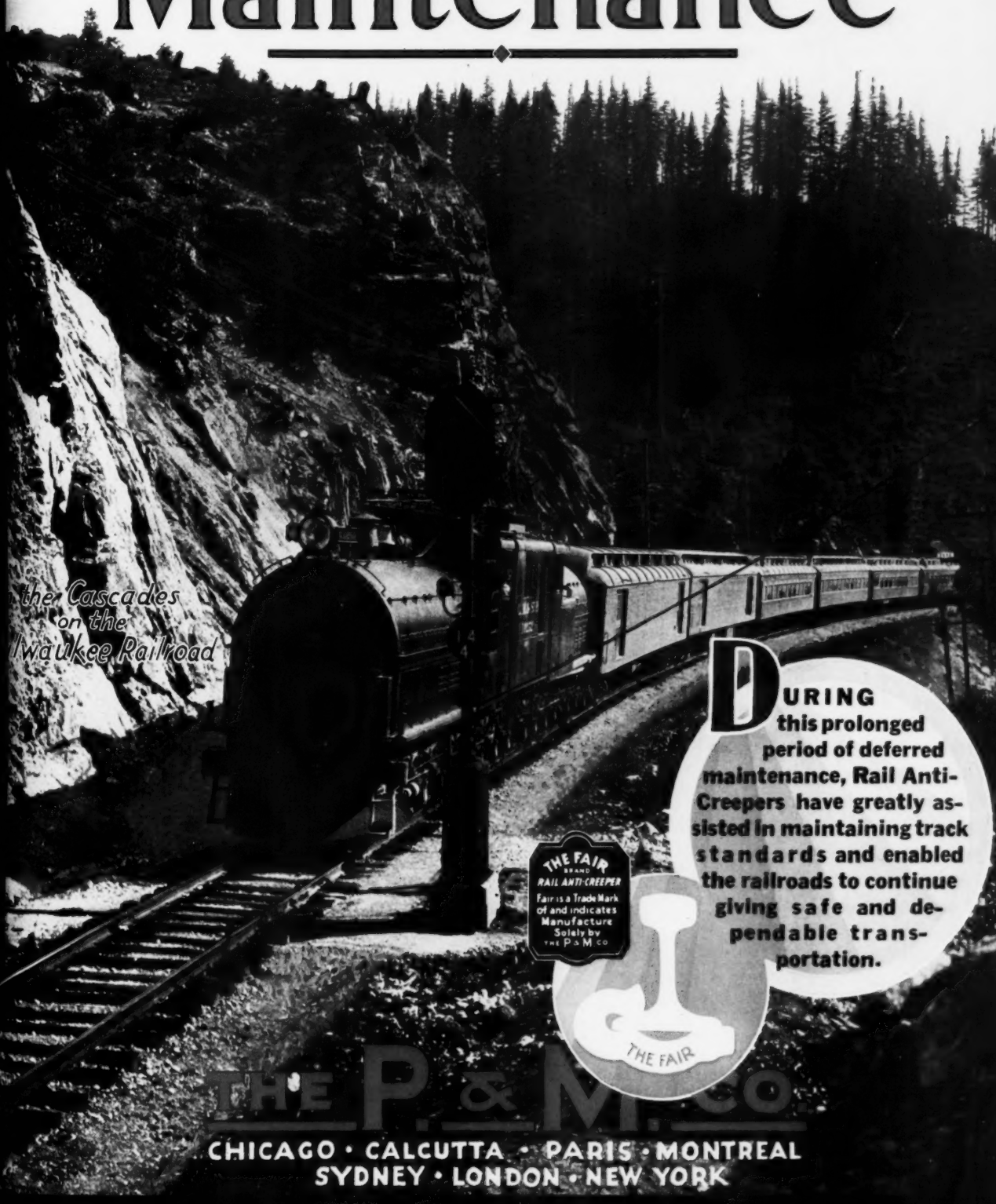
November, 1932

Railway Engineering and Maintenance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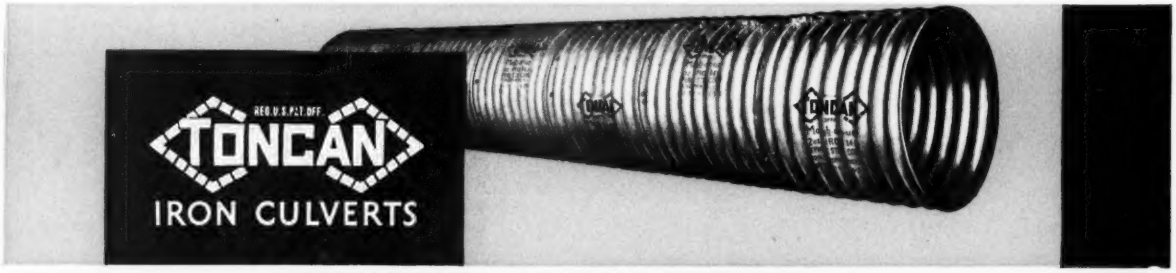

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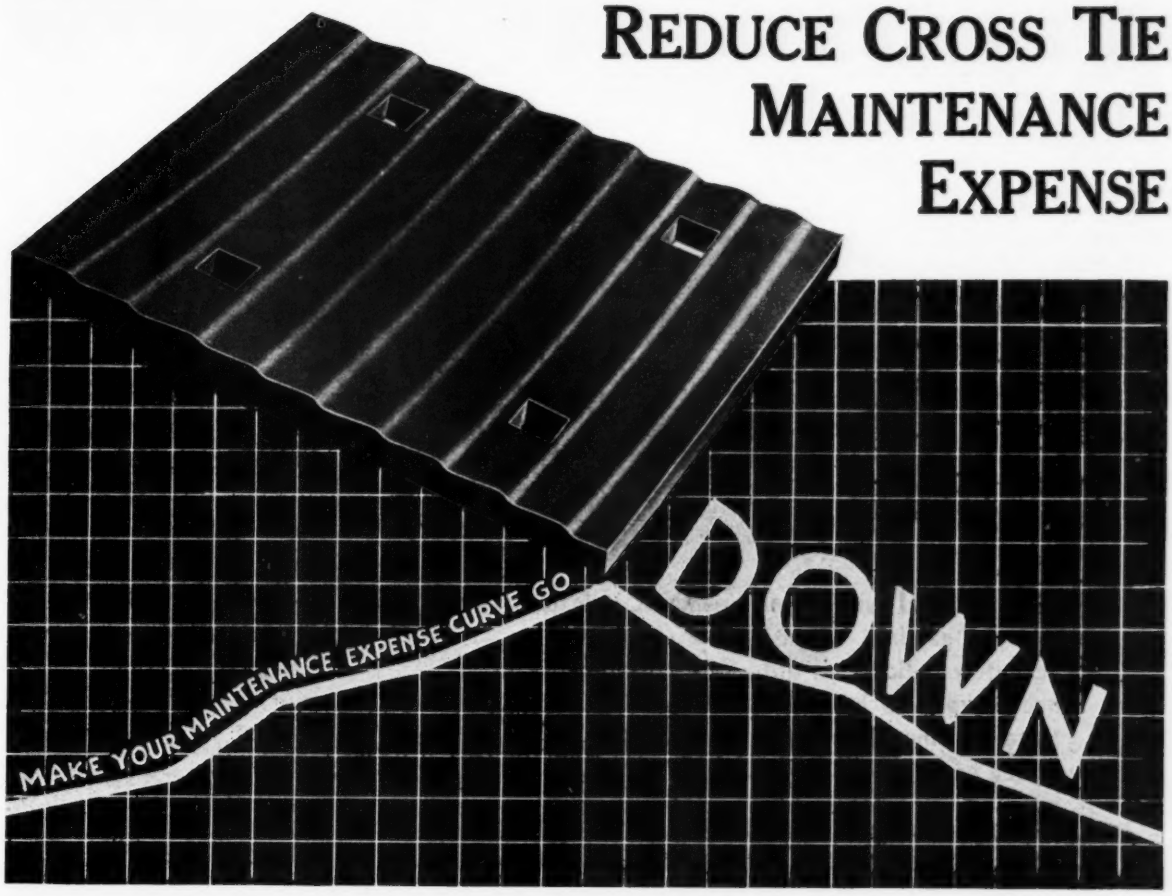
REDUCE CROSS TIE MAINTENANCE EXPENSE



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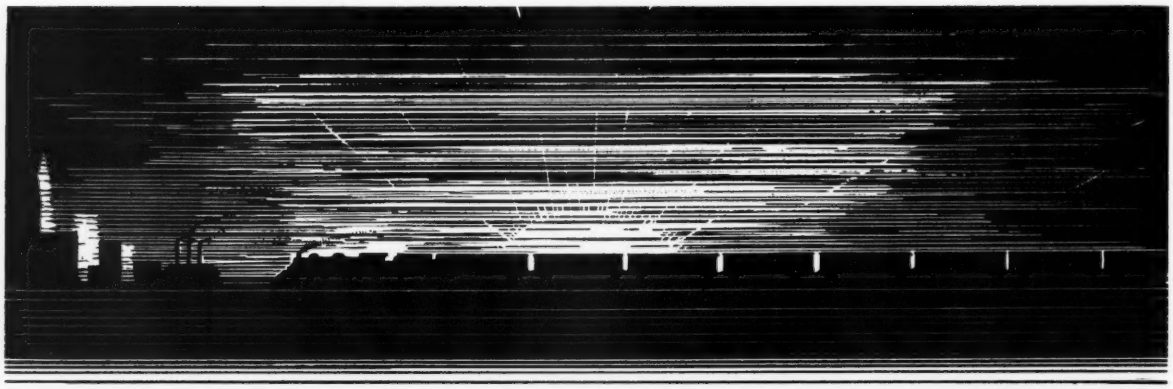

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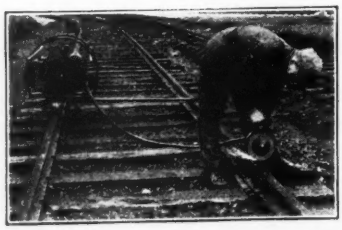
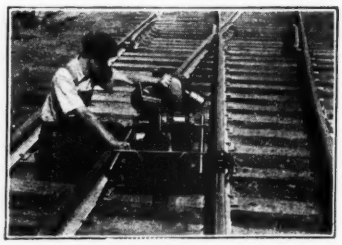
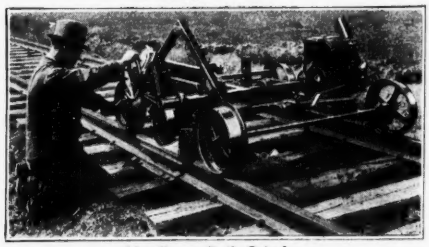


Nordberg Cross Grinder



Nordberg Rail Drill



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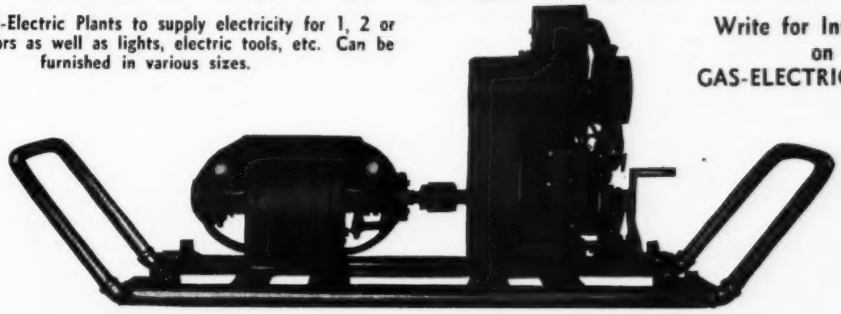

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No. 47 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING COMPANY

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Service Records

October 27, 1932

Dear Reader:

In these days when so much emphasis is being placed on service records, it has occurred to me that it may not be inappropriate to call attention to the records of our own publications. This thought has been crystallized by the centennial issue of the Railway Mechanical Engineer, companion publication to Railway Engineering and Maintenance, which has just come from the press, celebrating 100 years of continuous service to the mechanical department officers of American railroads. This publication, which was started only three years after the first locomotive was built in this country, is the oldest business paper in America.

Likewise, the Railway Age, the central unit of the railway service group of Simmons-Boardman publications, dates back to 1856, with a record of continuous service of more than three-quarters of a century. Other members of our railway service unit include Railway Signaling, established in 1908, and the Railway Electrical Engineer, first published in 1909.

As for Railway Engineering and Maintenance, it modestly points to its initial appearance in 1884, only two years after the organization of the Roadmasters and Maintenance of Way Association, whose semi-centennial was celebrated in our last issue. In this period of nearly a half-century, this publication which, in the early days, was known as the Roadmaster and Foreman, has endeavored through good times and bad to serve the interests of the maintenance of way department and to promote those ideas which would contribute to its greatest efficiency. To the extent that this result has been accomplished, we are indebted to those active leaders in railway and railway supply developments who have co-operated in contributing of their experience for the mutual good of all.

We hope that the Railway Mechanical Engineer may have before it another century of constructive service to the railways and that when 1984 rolls around, Railway Engineering and Maintenance may be able to point with pride to an equally constructive record.

Cordially yours,

Elmer T. Howson

ETH*JC

Editor.

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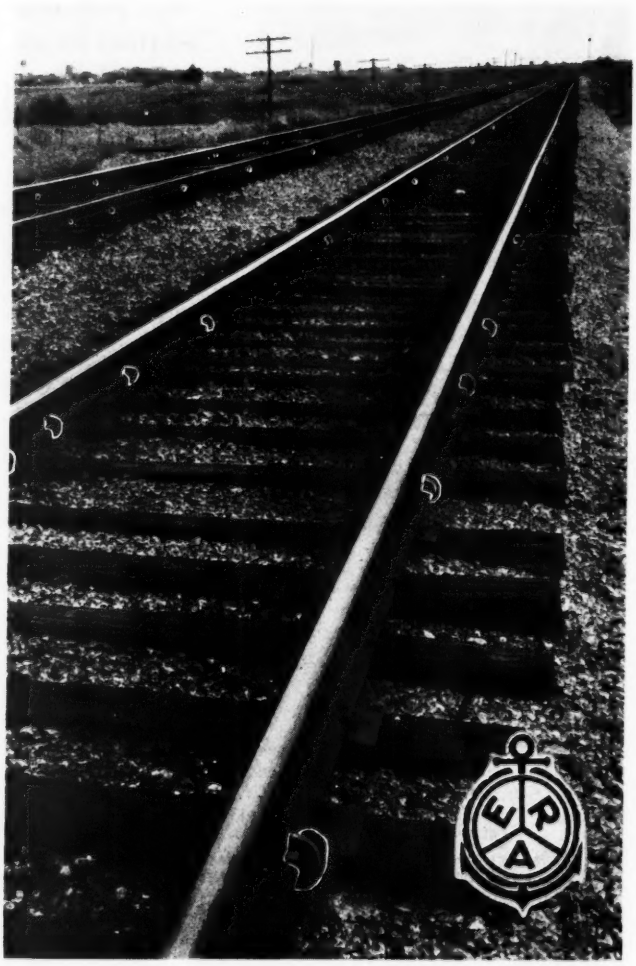

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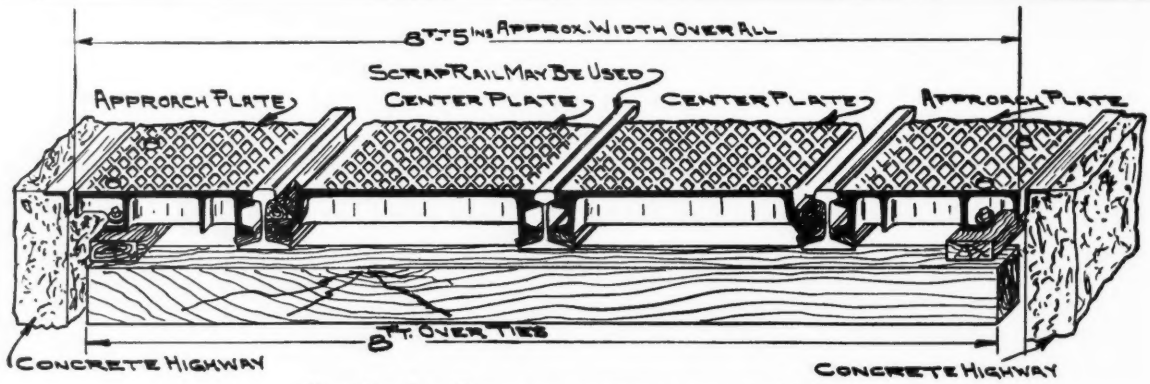

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Railway Engineering and Maintenance

RECOVERY

Business Is Getting Better

TO THOSE employees of the maintenance of way department who have suffered reductions in income through wage cuts or part-time employment, and even more to those employees who have been laid off through retrenchment measures, evidence that the tide of business has turned upward is most welcome. Such evidence is now at hand. Furthermore, it is at hand within the railway industry itself—in the weekly compilations of car loadings. This index is particularly convincing since the aggregate of car loadings constitutes a cross section of industry at large, reflecting the movement of traffic of all kinds throughout the entire country.

Car Loadings

In June, car loadings hit the lowest level of the present depression, averaging 491,589 per week. In September, they averaged 561,150, or 14 per cent more than in June. In the first three weeks of October, the latest period for which figures are available at this writing, they averaged 632,763, an increase of 141,174 cars per week, or almost 29 per cent over June.

This increase was in part seasonal, but only in part as is evident from comparison with previous years. Thus, the average increase in weekly loadings in October, as compared with June, in the five years ending with 1929, was 129,050 cars, or less than 12 per cent. In 1930 it was less than 23,000 cars, or only 2.4 per cent, and in 1931 it was less than 20,000 cars, or only 2.7 per cent. In other words, the increase in the number of cars loaded in the last four months exceeded the average for the same period in the last five years of peak business and was more than seven times greater than in either of the last two years, while the ratio of increase in the last three months was more than 10 times as great as in the last two years and nearly two and one-half times as great as in the five boom years of 1925-1929, inclusive. These loadings, constituting as they do a composite index of activity in all industries, present conclusive evidence that business at large, as well as on the railways, is getting appreciably better.

Earnings and Expenditures

The same upward trend is evident in the earnings' figures of the roads. Starting from total monthly gross earnings of only $237,813,054 in July, the total rose to $252,102,171 in August, and the first 21 roads to report their September earnings showed a still further gain of 10 per cent over August. The net railway operating income figures are still more striking. Starting with $11,596,852 in July, the roads earned $28,368,387 in August and the 21 roads referred to above showed a gain of more than 70 per cent in September, as compared with August.

That this improvement in earnings is having an almost immediate effect in railway expenditures is shown by a comparison of railway purchases compiled monthly by the Railway Age, in which the volume of orders placed in August shows an increase of $2,500,000, or more than 10 per cent as compared with July, an indication of the promptness with which the roads will enter the markets for materials and supplies, with corresponding additions to forces, when earnings permit.

Aside from the recovery in general business that is resulting from a gradual return of confidence and the exhaustion of stocks on dealers' shelves, this improvement is evidence also of the constructive effects of various measures that have been initiated by governmental and other agencies to aid business. Outstanding among these agencies is the Reconstruction Finance Corporation which, up to September 30, had advanced $264,366,933 to 53 roads to meet fixed charges and to pay taxes and other pressing obligations. In addition, the Railroad Credit Corporation, the agency formed by the railways in the closing days of last year to administer the pooled income from the freight rate increase, has loaned $28,719,279 of the $35,764,606 collected during the first seven months of the year, to needy roads to meet fixed interest charges.

Loans for Maintenance

Another measure which is tending to aid the railways is the action taken by Congress during the closing days of the last session, at the suggestion of President Hoover, to broaden the scope of the Reconstruction Finance Corporation's activities to include loans to railways to enable them to make good the deferred maintenance that has accrued during recent months, and thereby stimulate employment. Although this provision is only a few weeks old, several roads have already been granted loans for the repair of equipment and in at least one case for the construction of new equipment. Of even more direct interest to the maintenance of way department are two loans which have been granted railways for maintenance activities within the last week. One of these involves an advance of $100,000 to the Chicago & Eastern Illinois for the purchase and laying of 1,130 tons of rail, while the other is an advance of $1,000,000 to the Chicago &

North Western for the purchase and treatment of crossties.

That these developments are of direct concern to employees in the maintenance of way departments of the railways should be self-evident. Not only has the aid that is being given the railways by these governmental agencies prevented not a few receiverships and thereby continued the employment of many persons, but the improvement in business that is now so clearly evident, with its even greater increase in net income, cannot result in other than increased expenditures for labor and for materials and supplies to make needed repairs to track and roadway. Yes, business is getting better.

PERFORMANCE

The Output Per Man Has Greatly Increased

NO WORD was more common among employers of labor during the war than "turnover"; yet, because of the changes that have occurred through the years this term has become practically obsolete—indeed, at a recent meeting of railway engineers a question concerning turnover in track gangs was dismissed with a smile.

The disappearance of this word from the dictionary of the maintenance officer has, however, a more far-reaching significance than that of marking a change from a period of labor shortage to one of labor surplus, for with it has come a marked transition in the attitude of men toward their work. The reasons for this difference are too well known to demand elaboration here, but the fact is that men now do more work for a day's pay than they have done at any time in 25 years. New performance records are being reported nearly every time that one supervisory officer meets another.

This means that the established basic figures that have been used for estimating the money or the time required for doing almost any class of work are no longer correct. It behooves every officer to recognize this fact and revise the figures, whether he carries them in his head or in his notebook, which he uses in approximating the cost of proposed work.

THE PONTOON

A Unique Type of Movable Bridge Span

THE pontoon as a movable span to meet the requirements of navigation at a railway crossing of a river appears at first thought to be a carryover from more primitive days in bridge design and construction. But the fact that the Chicago, Milwaukee, St. Paul & Pacific replaced a structure of this type in kind less than a year ago is evidence of the practical nature of the pontoon—all the more so because of the long experience which this railway has had with structures of this type.

True, the Milwaukee's three pontoon spans, together with a fourth one abandoned some years ago, are all on branch lines of light traffic, but the fact that they were rebuilt at intervals of about 15 years (until the use of creosoted timber was adopted), thus affording repeated opportunity to consider the substitution of pier-supported movable spans, indicates that they have satisfied the requirements of economy, considering both investment and operating charges. Obviously the use of treated timber has enhanced rather than reduced the balance in favor of this type of structure.

The renewal of these floating spans has afforded periodic opportunity to develop improvements in design, and the present structures are unquestionably stiffer and better equipped than their predecessors, although basically the design has changed but little since the first pontoons were built at Prairie du Chien, Wis., and North McGregor, Iowa, in 1878. The article on page 674 of this issue serves as a record of structures that are unique in the history of American railway bridges.

THE ROADMASTER

Must Meet New Demands With Energy

IN TIMES of plenty when every activity is stimulated, many opportunities for applying more effective methods or for developing efficiency and economy in performance are ignored more or less unconsciously in the desire to keep every effort at its maximum and often under the necessity for working against a time limit. This does not imply that these things are lost sight of or that they are viewed indifferently. On the contrary, effective methods and efficiency of performance, which in many of their aspects also imply economy in performance, are fundamental to success in railway maintenance. There are few roadmasters who are not alert to the present trends with respect to both efficiency and economy. There are equally few who are not aware that the ultimate possibilities in the development of effective methods as well as in efficiency of performance have by no means been reached.

It is equally true, however, that many roadmasters have not heretofore taken the time or made the effort necessary to study and develop those refinements in practices which often produce such startling results in the way of better performance. Some have not planned their work in such a way as to produce the best results. Others have been satisfied to issue general instructions and leave the details to their section or extra-gang foremen. The ill effects of failing to grasp every opportunity to improve methods, of laxity in planning work or of inability to realize the benefits which are derived from alert attention to details may not be readily apparent when maintenance activities are at or near the maximum but they stand out prominently when appropriations are restricted.

It is a human trait to resist changes in customs and habits of thought. This has acted as a stabilizing agent to prevent ill-advised experiments in the development of the race and to preserve the advances which civilization has made. While good judgment should never be subordinated to enthusiasm in the development of new practices in maintenance or the alteration of those already in effect, this trait should never be employed, as has often

happened, to erect a barrier against improvements in methods or to maintain rigidity where flexibility is needed to meet changing conditions.

Morale is always important whether men are employed singly or in large units. Low morale is certain to breed low efficiency, while high morale is a most important element in maintaining an effective and efficient organization. As a factor in sustaining morale, respect for the ability, energy and viewpoint of superior officers is highly important if the energies of the workmen are to be directed with a view of obtaining the maximum value from their expenditure. Low morale in an officer will lower the morale of those under him. Critical and discontented habits of thought and conversation quickly infect subordinates, and many an otherwise promising career has been wrecked by an unwillingness to enter wholeheartedly into the execution of plans which were viewed with disfavor.

In an article in this issue, C. J. Geyer asserts that present conditions afford the roadmaster an opportunity such as has seldom been open to him to set his house in order and then to apply his energy and ability to maintaining the morale of his subordinates, to the improvement of his practices and then to hold the gains he has made by taking advantage of this opportunity.

DRAINAGE

How Modern Materials Have Affected Methods

THE article on page 662 of this issue describes an unusually interesting project for the correction of conditions which had been the cause of severe slumping and sliding of an embankment. However, the importance of this article is not confined to the service that it renders in telling the story of the work done on a particular piece of roadbed, for it serves also as an object lesson in the progress that has been made in drainage practices during the last ten years. It is not too much to say that we are in the midst of a new era in roadbed drainage.

This marked advance is the result of several developments, chief among which was the introduction of the perforated pipe now available in a variety of materials, most of these pipes being of a type that is capable of withstanding the effect of considerable distortion of the ground in which they are laid. Until the advent of perforated metal pipe possessing these attributes there was only one means of dealing with a deep-seated case of soft fill, namely, to construct French drains, which are, of course, expensive unless their use is confined to a more or less superficial treatment. The idea of going to the extreme of burrowing through the very base of an embankment was, of course, not even dreamed of.

This more recent development, as employed in its most extensive form in the embankment near Mobridge, is related directly to the introduction of the perforated pipe, but it necessarily awaited the devising of ready means for jacking and boring drainage and culvert pipe into fills. It is true that resort was had in this case to a small amount of ordinary tunneling, but this was incidental to the jacking. The thorough drainage of the entire mass of this fill was possible only because pipes were available that would draw the water from the material that surrounded them and could withstand the stresses of jacking and because effective and economical means were at hand for forcing these pipes deep into the fill.

We should not lose sight of the accumulated knowledge that is being gained through experience in the application of these modern facilities and methods. As a result, railway men are acquiring a better understanding of what takes place in a fill, of how to investigate the trouble and of the best methods of obtaining a satisfactory cure for any trouble that may appear.

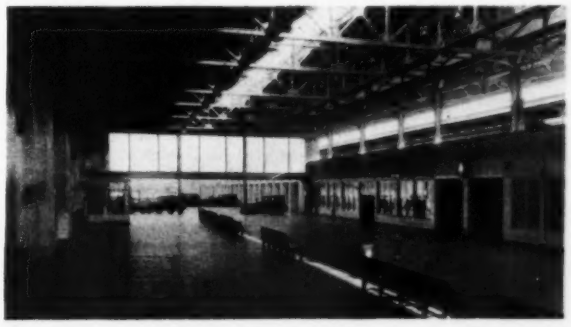
FIRE HYDRANTS

Now Is Time to Insure Winter Dependability

IN VIEW of the serious consequences of water-service failures it becomes increasingly important that no form of advance preparation be neglected which will insure a continuity of water delivery. While this applies generally to all deliveries of water, it should be given particular emphasis with respect to fire hydrants.

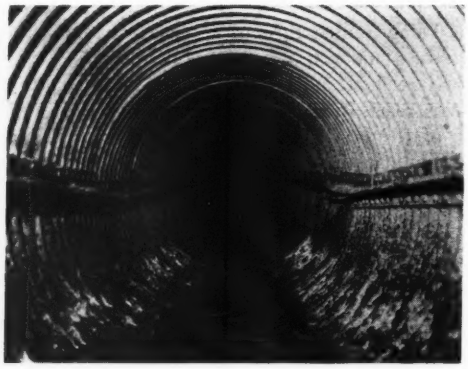
These hydrants are generally located at points of greatest fire risk. They are seldom used except in cases of emergency, at which time the need for them may be very great. If they are inoperative, there is no time available for investigation or repairs after a fire has once started. A frozen hydrant is about the most useless thing known. In fact, it may be worse than useless, for much time may be lost by the fire-fighting forces who have placed dependence on it.

It is axiomatic that any device for emergency use should be operative at all times. Where it is used at infrequent intervals, special precautions should be taken to keep it in this condition. In the case of fire hydrants, assuming that this has not already been done, there should be no further delay in going over every hydrant to assure that there is no leakage and that it is in working order. By December 1, at the latest, the work of protecting against frost should be completed. There are several well-known methods of doing this, none of which entails more than a nominal expense. The important thing to bear in mind is that those who have the duty of maintaining these facilities should be forehanded in the matter of winter protection, since in this case an ounce of prevention may be worth many pounds of cure.



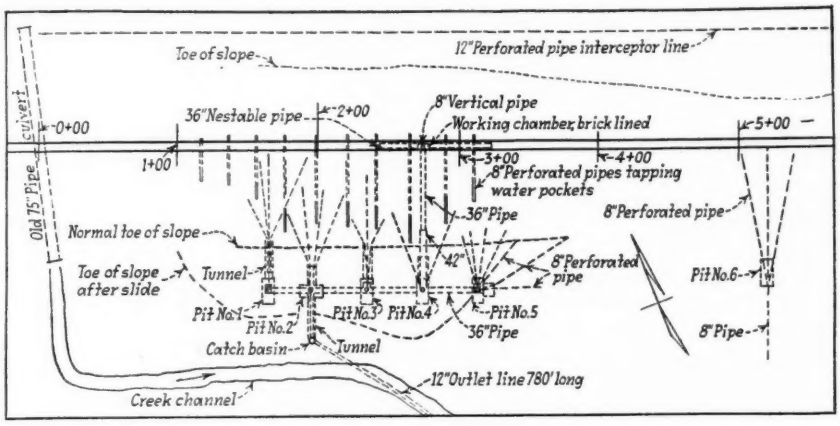
Concourse of the New Texas & Pacific Station at Ft. Worth, Tex.

Burrow Under Fill to Stop Slides



Above—View Inside of Nestable 36-in. Pipe Assembled in a Tunnel 60 ft. Below and Directly Under the Track

Drain lines driven under center of embankment carry off water that had softened fill and was responsible for serious trouble



General Plan of the Drainage System

MORE than 2,000 ft. of 8-in. corrugated iron pipe, 500 ft. of 36-in. pipe and 40 ft. of 42-in. pipe were inserted in an embankment by either jacketing or tunneling, in addition to 1,500 ft. of 12-in. pipe placed in trenches to serve as intercepting and out-fall drains, for the purpose of correcting the conditions responsible for a serious slide and subsidence on the Chicago, Milwaukee, St. Paul & Pacific main line near Mobridge, S. D. This project, which was undertaken after a thorough investigation of the cause of the unstable condition of the embankment, including the drilling of many test holes, comprises an excellent example of drainage work based on accurate knowledge of the conditions presented, and prosecuted along lines that would reach the seat of the trouble, regardless of the difficulties that these measures imposed. For example, most of the tunneling and packing was done from the bottoms of pits from 15 to 24 ft. below ground level, from which water had to be pumped constantly to permit the work to go on. The pump in one of these pits delivered 15,000 gal. per day. Most of the work was confined to a track distance of 300 ft. embracing the area subject to the most serious disturbance.

An Old Embankment

The embankment involved is from 50 to 60 ft. high within the limits of the longitudinal distance that imposed the principal difficulties. The natural ground surface at this point has a transverse slope such that the toe of the north slope of the embankment is from a few feet to as much as 20 ft. higher than the toe of the south slope. In spite of the fact that the embankment rendered satisfactory service for many years and was presumed to have become thoroughly solidified, evidence of an unstable condition was noted in 1930. At that time several large cracks appeared in the surface of the fill and they increased in size as time went on, followed at intervals by slides at various places in the area affected—sometimes on one slope and at other times on the other.

As the settlement took place, the track was raised on sand and gravel, while the loss of section due to slides was made good by widening the roadbed with material from borrow pits, and by May, 1931, it was found that the settlement accounted for in this way amounted to about 30 in. Emergency protection being deemed necessary at that time, a line of 40-ft. piles was driven on each side of the track for a distance of 180 ft., using 23 piles in the north row and 45 in the south row since the sliding was much more severe on the south side. A line of 8-in. by 16-in. stringers was bolted against the outside of each row of piles and the two rows were tied together at intervals of 8 ft. by 1-in. steel rods that passed under the track. This work was completed on June 6.

In spite of this however, the movement of this part of the embankment continued, and three days later, early in the morning, 210 ft. of the roadbed, embracing all of the part enclosed by the pile retaining walls and the upper half of the south slope, slumped from 10 to 15 ft. vertically and slightly to the south, breaking away from the north half of the fill on a cleavage plane coincident with the north line of piles. The south row

of piling dropped down and moved several feet to the south with the fill, the tension exerted by the tie rods being sufficient to break off most of the piles in the north row about 15 ft. below their tops. At the same time, pronounced heaving took place at the toe of the south slope, accompanied by the opening of large cracks in this bulged area.

Traffic was restored by driving a pile trestle of some 16 or 18 panels as quickly as possible, after which a thorough investigation of the conditions in and under the the fill was undertaken for the purpose of arriving at a basis for a permanent and economical method of stabilizing the embankment. It was found that the soil at the site of the fill is a clay loam over a stratified clay that breaks up into pieces of various sizes and is very greasy to the touch. This material is found to a depth varying from 3 or 4 ft. up to 15 ft. and is underlain by a hard blue clay extending to unknown depths.

Composition of the Embankment

The fill, which was constructed from material taken from nearby cuts and borrow pits, is largely clay although layers of sand and sandy clay were found near the base in a few locations, while the top 5 to 10 ft., was largely sand and gravel, much of which had been applied during the period of progressive settlement. It is apparent, however, from the large pockets of gravel found within the roadbed width that large quantities had been applied as ballast to compensate for settlement in past years.

Investigation disclosed also that the ground-water level south of the fill was from 12 to 15 ft. lower than on the north side, a condition favoring a ground-water flow from north to south. However, the conditions found were such as to point to water impounded in the pockets of pervious material under the roadbed as the primary cause of the trouble. Softening the clays, which have very little stability when wet, the water also reached cleavage planes between the subsurface strata and gave

A View Taken Shortly After the Slump and Slide—Note Break in Fill Marking the South Edge of the Slump

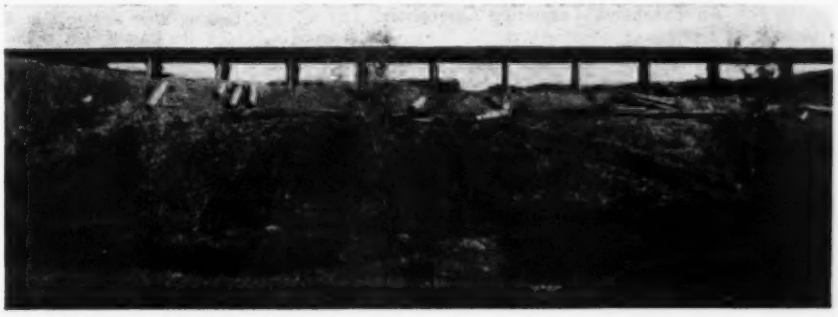
rise to a combination of slumping and sliding on the transverse slope to the south.

Based on this conclusion, it was decided that the most positive method of stopping the movement was to provide a drainage system for the removal of the water impounded in and below the fill and for the interception of the flow of ground water seeping through strata below the fill. This drainage system, as designed and installed, consists of three independent units, all of which were constructed of corrugated iron pipe.

One of these is a line of 12-in. perforated pipe 800 ft. long laid in a trench beyond the toe of the north slope for the purpose of intercepting subsurface water and carrying it to a creek that is conducted under the embankment through a concrete pipe culvert just west of the location of the slump in the fill. Another unit of the system consists of a group of ten 8-in. perforated pipes that were driven into the embankment from the face of the south slope to tap the bottoms of water pockets from 16 to 26 ft. below track level. These pipes are spaced from 20 to 25 ft. apart and are from 37 to 73 ft. long. The third and most elaborate feature of this drainage installation is a system of subsurface drains designed to release water from the strata supporting the fill, special pains being taken to follow numerous well defined cleavage planes so as to remove the water which had served to lubricate them.

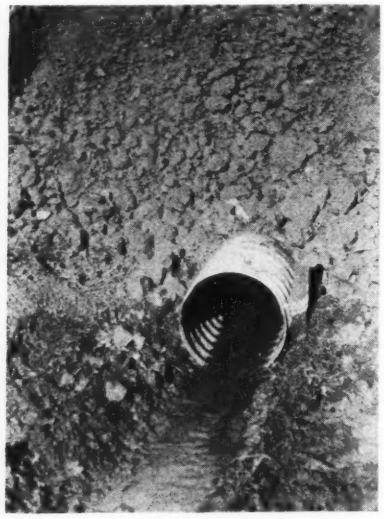
This last named feature of the project involved several serious problems, for although this system consisted in the main of 8-in. perforated pipes that were forced into place by jacks, the desired location for these drainage lines was so far below the ground surface south of the embankment that both the jacking and provision for an adequate outfall drain introduced serious problems.

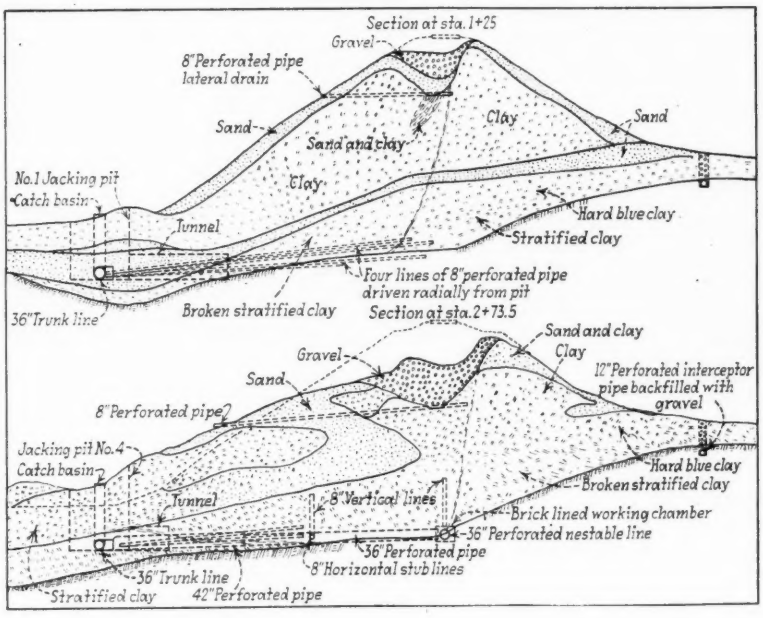
On a line 100 ft. south of and parallel with the center line of the track, five pits, 8 ft. wide by 18 ft. long and spaced from 30 to 40 ft. apart, were, therefore, excavated to a depth of from 15 to 24 ft. below the



Above—Jacking Pit No. 2 At the Right—Traffic Was Handled Across the Slumped Embankment on a Pile Trestle. Note the Heaved Material in the Foreground

surface or from 62 to 68 ft. below track level. As all of these pits fell within the limits of the heaved material at the base of the slide, an unstable soil condition was encountered that gave rise to the use of heavily braced sheeting in the pits for their full depth, while the amount of water encountered was such as to require pumping until the outlet drain was completed, as described later. These pits served as the starting points for the jacking and tunneling operations required for the construction of the drainage system, which consists primarily of 8-in. perforated pipes driven toward the center of the fill, following the cleavage planes as closely as possible. It includes also a 36-in. pipe connecting the five pits and a 12-in. pipe extending 40 ft. to the south from pit No. 2 to a catch basin, whence a 12-in. outfall line could be installed in a trench to an outlet in the creek bed, a distance of 1,200 ft. to the southeast.





Above—End of the Long Outlet Line on the South Side. At the Right—Two Cross Sections of the Embankment Showing Conditions at the Time the Drainage System Was Completed But Before the Embankment Was Restored

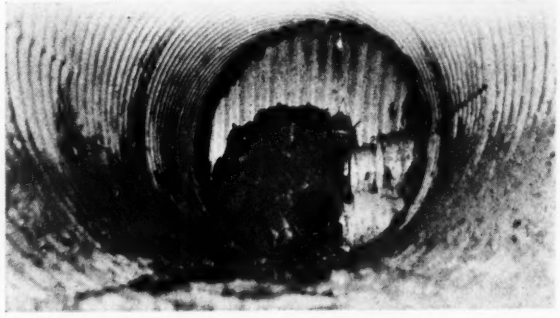
The 36-in. pipe was installed by the jacking method now frequently employed in placing culvert pipe under old embankments, while the 8-in pipe was placed by means of a small pipe-jacking machine. However, considerable tunneling was also done, for example, in placing the 12-in. pipe from pit No. 2 to the catch basin. Also, with the exception of the work at pit No. 5 from which seven 8-in. pipes were jacked in radial lines direct from the pit, tunnels were extended northward from 15 to 25 ft. from the pits before the jacking of the 8-in. lines was started. These tunnels were timbered.

An Extensive Tunneling Operation

In all, 20 lines of 8-in. pipe were driven under the fill, their lengths ranging from about 40 ft. to 90 ft. In addition, three lines, each 90 ft. long, were driven from an independent pit, No. 6, located 200 ft. east of pit No. 5, but in this case an 8-in. pipe driven south a distance of 50 ft. afforded the necessary outlet for the water without any connection with the collection and run-off system provided for the other five pits. However, the most spectacular feature of the project was the operation carried on from pit No. 4.

Starting from this pit, a tunnel was excavated 15 ft. to the north and from the end of this tunnel a 42-in. pipe was jacked in 20 ft. where a reduction was made to a 36-in. pipe which was jacked north an additional 60 ft., or so that its inner end was directly under the track. Here a working chamber was excavated from which a 36-in. nestable pipe (delivered in semi-cylindrical sections with longitudinal flanges) was installed by tunneling for about 30 ft. west and 45 ft. east directly under the track. This longitudinal pipe line was then used as the chamber from which five lines of 8-in. pipe were jacked vertically up into the fill a distance of 13 ft., while at a point 38 ft. to the south, in the 36-in. approach pipe to the longitudinal line, 8-in. lines were projected upward and to the east and west, for a distance of about 10 ft.

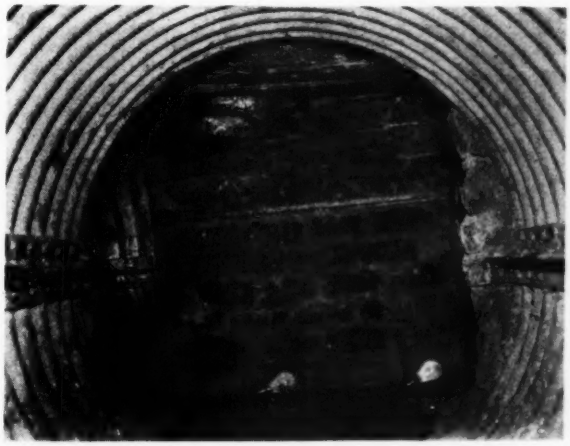
The excavation required for this extensive drainage system varied from work in soft sticky clay to hard shale. The spoil was hauled through the pipes and tunnels in small skips that were moved on 18-in. gage pipe tracks to the pits, whence they were hoisted by small stiff-leg derricks equipped with hand-operated crabs. During the progress of the work it was noted that pumping from the pits along the south toe of the slope was accompanied by a fall in the water level in a pond north of the fill about 1,000 ft. east of the slide, the elevation of the water in the pond being about 18 ft. higher than the elevation of the water table under



Looking West in the 36-in. Collector Line Toward Pit No. 1, Showing the Outfall Ends of the Three 8-in. Perforated Drain Lines

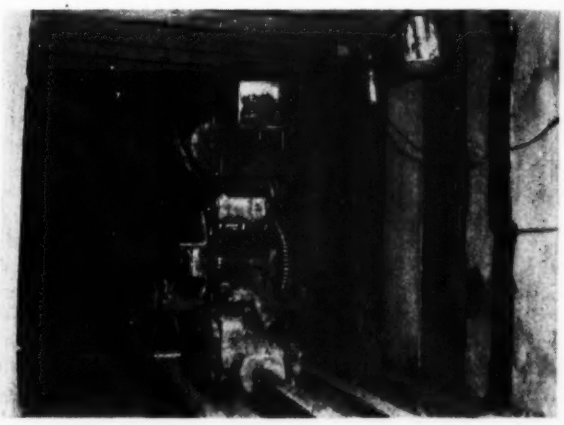
the center line of the fill at the slide. On the basis of this information, a line of 196 ft. of 48-in. corrugated pipe was jacked through the fill to drain the pond, and insure that no further water would enter the slide area from this source.

The drainage work was started on October 2, 1931, and completed on December 6, but owing to the frozen



In the Interceptor Room Where the 36-in. Pipe Under the Center Line of the Roadbed Connects With the Lateral Leading to Pit No. 4

condition of the ground, completion of the backfilling was deferred until the past summer. This work was done by train haul, the cars being dumped from the trestle that had been built across the gap in the roadbed formed by the slide, and after about 100 carloads had been placed, heavy settlement, together with evidence of an unstable condition down the slopes, led to a deci-



A View Showing the Boring and Jacking Machine Used to Drive the 8-in. Perforated Pipes Into the Fill

sion to suspend the train haul filling until a berm could be placed at the bottom of the south slope by team work.

This behavior of the fill gave rise to some question concerning the effectiveness of the drainage system, but a thorough examination made in September, of all drainage lines that could be entered by a man, disclosed no signs of distortion and showed that the system was functioning effectively. The discharge at the time of the inspection was 41.5 gal. per hour. Moreover, during June, following several days of heavy rain, the flow from the drainage system was 360 gal. per hour. As a further check three test holes were drilled from the top of the fill to a depth of several feet into the natural ground beneath and these were all so dry that it was necessary to introduce water to carry on the drilling.

Based on this investigation it was concluded that there was not enough water in the fill to have contributed in any way to the settlement, but that it was due to the closing up of the extensive voids that were formed by the breaking up and cracking of the fill during the course of the slide and of such voids that were left by the water as it was drained away.

Armco pipe was used throughout. The investigation and installation were made by the Drainage Engineering Company, Middletown, Ohio. The work was carried out under the direction of Arthur Daniels, district engineer for the Chicago Milwaukee St. Paul & Pacific at Minneapolis Minn., after plans had been approved by W. H. Penfield, engineer maintenance of way.

Tight Bolts Are Factors in Forming of Track Kink

TRACK bolts that were too tight to permit adequate expansion of the rails during warm weather and a deficiency of ballast at the ends of the ties were mentioned as factors in the formation of a track kink that resulted in the derailment of a freight train on the Cleveland, Cincinnati, Chicago & St. Louis, on July 25 near DeGraff, Ohio, in a report of the Bureau of Safety of the Interstate Commerce Commission. The engine and the first eight cars of the train, which consisted of 74 cars and the caboose, passed safely over the kink, while 40 of the cars were derailed. The following information is abstracted from the report of the Bureau of Safety.

The accident occurred in double-track territory on a compound curve, 2,079 ft. long, having a maximum curvature of 2 deg. 4½ min. The track in this vicinity is laid with 105-lb. 33-ft. rails with 20 hardwood ties to each panel and is single-spiked, fully tie-plated and ballasted to a depth of about 12 in. with washed gravel. The standard superelevation for this degree of curve on this road is 5 in. and in the vicinity of the accident is was found that the superelevation varied from 5/16 in. low at several points to 3/16 in. high at one point. The alinement was good and all ties were well tamped.

On the day of the derailment, which took place at 3:42 p. m., the temperature was about 89 deg. F. and the weather was clear. The speed of the train was estimated to be between 45 and 60 miles an hour.

The track foreman on this territory, who at that time was allowed to work his crew only three days a week, testified that on July 21 and 22 he had done some surfacing work on the curve, and that on the date of the accident, with the assistance of a track gang from an adjoining section, he had lined the curve inward about ½-in. at a point somewhat more than a rail length east of the point of the accident. He testified further that less than a minute before the train passed he had sighted along the track and had seen nothing unusual.

Examination of the track subsequent to the accident disclosed that the ballast shoulder on the outside of the track involved was about 8½ in. narrower than the railroad's standard and that the track bolts were sufficiently tight to interfere with expansion of the rails in hot weather. There was sufficient space at the rail ends to permit this expansion if the bolts had been loosened temporarily and then retightened, as required by the railroad's maintenance of way rules. However, the nuts of the track bolts were covered with oil and dirt and gave no evidence that a wrench had recently been applied to them.

Section of the Train Shed at Hoboken With Its New Top Dressing of Aluminum Paint

Spray Guns Save in Painting Large Train Shed

Use of five pressure outfits by a small gang on the Lackawanna results in effective work at less cost

CONVINCED of the economy and effectiveness of spray painting, the Delaware, Lackawanna & Western, which purchased its first spray painting equipment in 1926, has been extending the scope of this method of painting until, during the past summer, it included all of the steelwork of the large Bush-type train shed at its passenger terminal at Hoboken, N. J., which covers an area of approximately five acres. For the first time, the spraying method was used almost exclusively on the train shed, and extended even to the spot painting with red lead following cleaning operations, all of which were carried out with air-operated tools. The use of brushes within the shed area was confined to the painting of the columns, which were painted a different color than the shed steelwork and which would have required an unreasonable amount of moving of the spraying equipment, and to the painting of the inter-track fences, which would have involved a considerable loss of paint under the spraying method.

The lower concourse at the terminal, immediately at the east end of the train shed, was also repainted. Here, the brushing method was used exclusively owing to the large and continual movement of passengers within this area. This latter work, plus the brush painting within the shed area proper, amounted to only about 10 per cent of the painting project as a whole.

As a result of utilizing pneumatic cleaning tools and the spray method of painting on the shed, the work was done in about one-half the time that would have been required if hand cleaning and brush painting had been used exclusively; the paint coats applied are believed to be equally as satisfactory as brush coats; and the total cost of the work was materially less than that of painting the shed previously by the brush method, in spite of the fact that the conditions under which the work was done were more severe than during any previous painting.

Extensive Work Involved

The painting of the shed at Hoboken is of interest both because of the effective use made of spraying equipment in this type of work, and also because of certain details of the equipment and methods used, which made it possible to carry out the work in a most satisfactory manner. The shed, which was built in 1906, is 600 ft. long by 340 ft. wide and extends over 14 tracks and nine 22-ft. low concrete platforms. It has a structural steel roof frame consisting essentially of a series of multiple arch steel girders, spaced 27 ft. apart, the individual arched girders having spans of 44 ft. and extending from the center of one platform, over two intermediate tracks, to the center of the next platform. The roof deck is of concrete slab construction with skylights at intervals over the platforms and longitudinal smoke ducts over each track and between tracks. This entire roof structure is carried on ornamental cast iron columns, which are laid out in nine longitudinal rows through the center of the platforms, there being 27 columns in each row.

Painting the shed by the spray method had both advantages and disadvantages. The major disadvantage was the fact that the work had to be done while about 200 trains and 60,000 passengers used the terminal daily. Since it was considered inadvisable to operate the spray guns over the heads of passengers passing to and from trains, the use of the spraying method necessitated careful programing of the work to keep clear of trains receiving or discharging passengers and to avoid interference with normal train movements, especially during the rush hours of the day.

Favorable to the use of the spraying method was the greater speed with which the work could be done, the shorter periods during which any platform or track would have to be occupied at any one time, and, in the end, the reduced cost of the work through the largely reduced man-hours necessary to carry it out. Favorable also was the fact that the shed is served by compressed air from the terminal power plant, with outlets at the stubbed end of each track, thereby obviating the cost and inconvenience of using portable air compressors within the platform areas.

Five Spraying Outfits Employed

In carrying out the painting of the shed it was necessary first to do quite extensive cleaning of the steel, the shed not having been painted since 1924, and then only in part, the last complete painting having been in 1917. All of the cleaning work was carried out with air-operated tools, including chipping hammers and scaling tools, this resulting in a large saving over what the same work would have cost with hand tools. Air for the operation of the tools was taken directly from temporary pipe lines laid along alternate pairs of tracks and connected with the permanent lines of the terminal compressed air supply system.

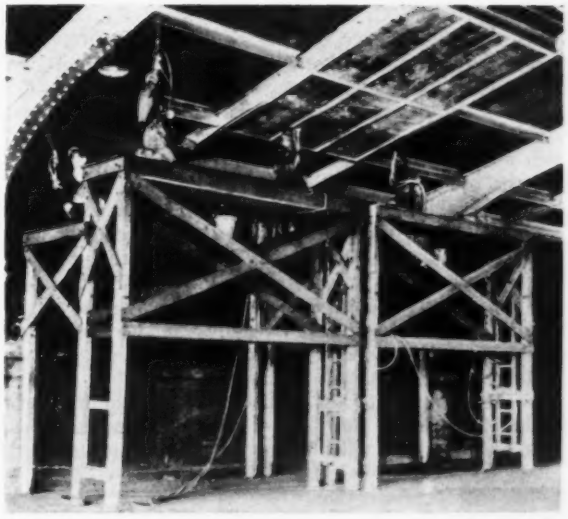
Practically all of the cleaning was done from a movable scaffold and was followed immediately by spot painting with red lead and oil applied by a spray gun. In fact, both the cleaning and the spot painting were done from the same scaffold, thus giving immediate protection to the steel bared in the cleaning work and, at the same time, avoiding a duplication of movements of the scaffold.

Following the spot coat, all of the steel of the framework was given a base coat of gray lead paint, and later, a top coat of aluminum paint, the aluminum paint being used primarily because of its light reflecting quality and the possibility of its greater resistance to the deteriorating action of engine gases. The columns, which were painted with brushes, were given two full coats of paint, the first brown and the second bronze-green.

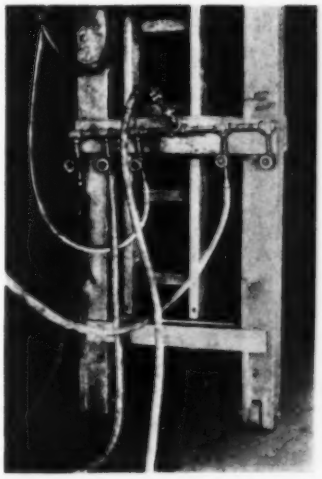
Five paint spraying outfits were used in the work, these being of the De Vilbiss and Matthews twin-hose, single-gun types, and Dunn single-hose type, all with five-gallon containers. Ordinarily, four of the outfits were kept together and were worked from the same scaffold, while the fifth was moved about and used where the work was of such nature that it could be operated best alone. Air for the operation of the spray guns was taken from the same lines that furnished air to the cleaning tools, except on a small part of the work, out of reach from these lines, where a portable air compressor was used.

In the case of the single spraying outfit, the air hose line was connected directly to the different outlets of the temporary supply lines as were found most convenient, while in the case of the four spraying outfits operated together, a main hose supply line was used to bring the air from the temporary supply lines to a special five-outlet manifold attached to the scaffold. All of the outlets of the manifold were equipped with hand valves so that air could be taken from any or all of them at a time, as desired.

The main scaffold was of the rigid platform type, of bolted timber construction, and was not only mounted on wheels to permit its easy movement over the platforms, but was braced in such manner as to permit the free movement of passengers beneath it in passing to and from trains. Of bolted construction, the scaffold was designed to permit dismantling and storing for

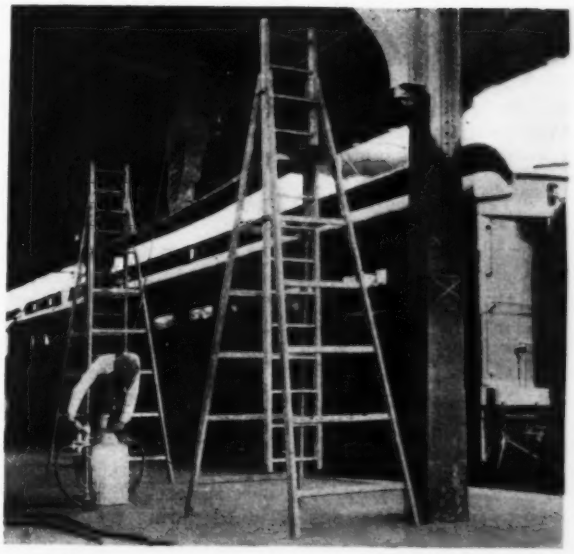


The Major Part of the Painting Was Done With Four Paint Spraying Units Operated From the Scaffold Shown Above



The Manifold in the Air Distribution System (at the Right), Showing the Air Inlet and Four of Five Outlets for Paint Spray Unit Attachment in Use

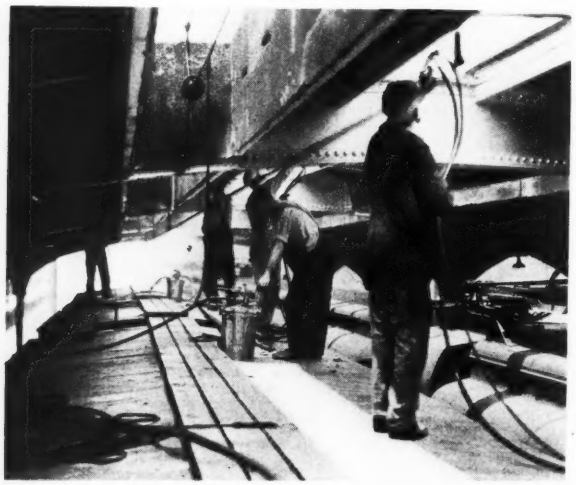
A Single Paint Spraying Unit and Ladder Scaffolding Was Used in Some Areas of the Shed as Shown Below



future use. In fact, the scaffold is said to be about 17 years old, and to have been used extensively in a wide range of repair work about the passenger terminal area in this period of time.

The scaffold consisted essentially of two units fastened together, each 14 ft. long by 7½ ft. wide, and each with platforms at two levels, one about 12 ft. high and the other 14 ft. high, this arrangement being provided to enable the men to reach the different elevations of the shed roof with the greatest ease and convenience. All of the painting equipment, including the material tanks of the spraying outfits, was carried about on the scaffold, usually on the lower of the two decks. Thus, the different operators could readily attend to their own equipment and, at the same time, no time was lost in moving it about separate from the scaffold.

In the normal progress of the work, the painting proceeded first down one side of the platform and then back on the other side, taking in all of the steelwork



Four Spray Guns in Operation From the Tops of the Box Cars Minimized the Time Required in Painting Over the Tracks and, Thereby, Interference With Traffic

within reach, which included everything except that part extending over the tracks. Owing to the length of the shed, 22 moves of the scaffold were necessary in passing from end to end. As a result, the cleaning and application of the two top coats required a total of 132 moves of the scaffold on each platform. While this appears to be a large number of shifts, it was no more than would have been required if the work had been done by the brush method, and was, in reality, a minimum considering the large area covered. Furthermore, mounted on wheels, each move of the scaffold was made with as little as two to three minutes' interruption to the work.

Painting Above Tracks Done From Car Roofs

The cleaning and painting of that part of the shed framework directly over and between the tracks were done from the tops of two box cars, coupled together and pushed in on the different tracks at assigned times by a switch engine. With the spraying equipment located within or on top of the cars, as most convenient, and the cars pinched along the tracks by car movers as the work progressed, this method was found most effective in reaching those parts of the shed inaccessible from the platform scaffold. An average of eight moves of the cars were necessary on each track for each coat, and the average time a track was occupied during the application of a single coat ranged from 1½ to 1¾ hr.

Owing to the large number of train movements and the heavy passenger traffic at the terminal, the work had to be planned most carefully. Little could be done during the rush hours of the morning except at specific points where there would be little or no interference with passengers or trains. However, immediately following the peak of the morning traffic, about 9:30, one of the tracks was taken out of service so that the painters, working from the tops of the box cars, could paint the steelwork above it. Since the entire terminal is equipped with overhead catenary construction for the electric operation of the Lackawanna's suburban trains, it was necessary to cut off the current on the track occupied. This detail was attended to by an electrician who was constantly with the painting crew, even when it was working from the platform scaffold.

Upon the completion of the work over any track, which was usually by 11 a. m., the painting cars were shifted to a second track that was taken out of service for painting there. Work over this second track had to be completed by 2 p. m. in order that all tracks at the terminal be restored to service by that time. At or before 2 o'clock the spray painting equipment was moved to the platform scaffold at the point where painting above the platforms was to be resumed, and no further occupation of a track was attempted until the following morning.

The sections of the shed to be painted on a specific day or during specific hours of the day were determined largely by traffic conditions. On several occasions it was necessary to work well into the evening, after the evening rush hours, in order to have access to certain areas, and, in the case of one section of the shed located directly over one of the tracks used constantly for switching during week days, it was necessary to do the painting on Sundays. Less concern was necessary about interfering with or soiling the clothing of passengers where brush painting was being done, but even this work was shifted about to a certain extent to avoid the rush hour crowds.

Moving Equipment a Simple Matter

Some moving of the paint spraying equipment was necessary when the work was shifted from the cars to the scaffold and vice versa, but this required a relatively small amount of time and labor. Even the heaviest units of the spraying equipment, the material containers, weighed less than 100 lb. when full of paint, so that it was a relatively simple matter to hoist and lower them by means of rope without special hoisting equipment. In many cases the raising and lowering of the equipment was completely avoided in shifting the work between the cars and the scaffold, this being done by moving the cars to a point directly alongside the scaffold and thereby making it possible to transfer the equipment directly from one to the other at practically the same level. Only infrequently was it necessary to move the equipment when replenishing the paint supply. Ordinarily, one filling of the paint containers in the morning would carry the work along until at least noon, and a second filling until the end of the day. All paint was hoisted, ready mixed, to the level of the paint containers, precluding the movement of the containers for this purpose, and all cleaning of the equipment at the close of each day's work was done without moving the equipment from the scaffold. In addition to minimizing the effort expended in moving the equipment, this kept it beyond the reach and out of the way of passengers.

With an average crew of about 16 men and a foreman, and the five paint spraying outfits, the train shed

was cleaned and painted two coats in 78 working days, or a total of 10,642 man-hours. Approximately 1,300 gal. of paint were used to complete the job.

In spite of the greater inconvenience experienced in carrying out the recent work as compared with that in 1917 when the shed was last painted as a whole, due largely to the electrification of the terminal and greater interference of traffic, the time required in the painting work by the spray method, including the cleaning, was approximately 11,500 man-hours less than that required to paint the shed by the brush method and do the cleaning by hand, using scrapers, chipping hammers, wire brushes, etc., at the earlier date.

The painting was carried out under the direction of George J. Ray, chief engineer of the Lackawanna, and under the supervision of B. E. Miller, master painter.

Census Bureau Reports Tie Purchases in 1931

ACCORDING to a preliminary tabulation prepared by the U. S. Bureau of the Census, the steam railways of the United States purchased 43,737,809 crossties in 1931, a reduction of 46.3 per cent compared with the 81,341,663 crossties purchased in 1929. The Bureau of the Census compiles these figures only every second year, so no corresponding data are available for 1930. Corresponding tabulations for bridge and switch ties show that the railroads bought 199,905 M. ft. b.m. in 1931, which is 33.8 per cent less than the 302,125 M. ft. b.m. purchased in 1929.

As shown in the tables, the purchases are divided between treated and untreated ties, although the figures for treated ties should not be confused with those prepared by the Forest Service of the U. S. Department of Agriculture in co-operation with the American Wood-Preservers' Association, as abstracted in *Railway Engineering and Maintenance* for July, page 449, because the figures presented on this page take no account of ties treated after purchase. According to the table 9,242,595 treated crossties and 34,495,214 untreated crossties were purchased in 1931, compared with 16,739,864 treated crossties and 64,601,799 untreated crossties in 1929. Similarly, of the switch and bridge ties purchased in 1931, 48,220 M. ft. b.m. were treated and 151,685 M. ft. b.m. were untreated, compared with 59,335 M. ft. b.m. that were treated and 242,790 M. ft. b.m. that were bought untreated in 1929.

Crossties Purchased by Steam Railways in 1931

Class of ties and kind of wood	Number of ties purchased: Treated	Untreated	Total
Group Ua:			
Heart white oaks	126,419	6,152,924	6,279,343
Group Ub:			
Heart Douglas fir	225,210	2,071,339	2,296,549
Heart pines	316,068	1,345,660	1,661,728
Group Uc:			
Heart cedars	.....	298,005	298,005
Heart cypress	1,000	3,170,322	3,171,322
Heart redwood	1,636	138,316	139,952
Group Ud:			
Heart chestnut	3,020	56,649	59,669
Not specified	14,673	88,245	102,918
Class U, total*	688,026	13,321,460	14,009,486
Group Ta:			
Ashes	2,773	22,593	25,366
Hickories	.....	19,961	19,961
Red Oaks	3,403,703	5,491,839	8,895,542
Sap white oaks	188,301	531,559	719,860
Not specified	45,535	2,239,577	2,285,112
Group Tb:			
Sap cedars	.....	979,077	979,077
Sap cypress	.....	25,303	25,303
Sap Douglas fir	201,954	480,175	682,129
Hemlocks	3,780	996,522	1,000,302
Larches (tamarack)	28,457	285,755	314,212
Sap pines	2,840,262	5,839,435	8,679,697
Group Tc:			
Beech	63,584	155,341	218,925
Birches	414,164	270,946	685,110
Cherries	.....	10,946	10,946
Gums	71,592	794,152	865,744
Hard maples	116,862	450,036	566,898
Not specified	457,952	1,652,286	2,110,238
Group Td:			
Sap chestnut	1,960	7,605	9,565
Soft maples	231	5,433	5,664
Spruces	.....	335,657	335,657
Sycamores	16,723	.....	16,723
Not specified	.....	314,746	314,746
Class T, total†	7,857,833	20,908,944	28,766,777
Miscellaneous	696,736	264,810	961,546
All classes	9,242,595	34,495,214	43,737,809

* Ties which may be used untreated.
† Ties which should be treated.

Bridge Ties and Switch Ties Purchased by Steam Railways in 1931

Class of ties and kind of wood	Quantity purchased (M feet, b.m.): Treated	Untreated	Total
Group Ua:			
Heart white oaks	547	32,970	33,517
Group Ub:			
Heart Douglas fir	178	19,859	20,037
Heart pines	1,108	10,029	11,137
Group Uc:			
Heart cedars	.....	.....	.....
Heart cypress	14	7,602	7,616
Heart redwood	9	374	383
Group Ud:			
Heart chestnut	.....	.....	.....
Not specified	24	179	203
Class U, total*	1,880	71,013	72,893
Group Ta:			
Red oaks	12,982	45,889	58,871
Sap white oaks	859	5,133	5,992
Not specified	.....	1,699	1,699
Group Tb:			
Sap cedars	35	.....	35
Sap cypress	.....	23	23
Sap Douglas fir	2,520	3,358	5,878
Hemlocks	252	812	1,064
Larches (tamarack)	12	480	492
Sap pines	5,401	15,292	20,693
Group Tc:			
Beech	961	126	1,087
Birches	14,640	115	14,755
Gums	316	3,289	3,605
Hard maples	2,814	1,999	4,813
Other	422	2,199	2,621
Group Td:			
Sap chestnut	.....	.....	.....
Soft maples	10	.....	10
Spruces	135	140	275
Class T, total†	41,359	80,554	121,913
Miscellaneous	4,981	118	5,099
All classes	48,220	151,685	199,905

* Ties which may be used untreated.
† Ties which should be treated.

A Dragline Excavator—The Modern Construction Utility

Improvement Shown in Accident Record

THAT the maintenance of way and structures department is making progress in reducing the number of employees killed and injured while on duty was evident in the committee reports and individual papers that were presented at Washington, D. C., on October 4-6, before the twelfth annual meeting of the Safety section, American Railway Association, which has been merged with the Steam Railroad section of the National Safety Council.

Table I—Casualties to Employees on Duty—Class I Railways

Class of Person	1931		Per Million Man-Hours 1931		Percent Decrease in Rate Per Million Man-Hours 1931 under 1923		
	Killed	Injured	Killed	Injured	Killed	Injured	Total
I. Executives, Officials, and Staff Assistants	3	20	0.08	0.52	57.9	70.3	69.1
II. Professional, Clerical and General..	24	573	0.05	1.09	...	57.1	56.0
III. Maintenance of Way and Structures	158	5099	0.26	8.26	46.9	68.3	67.9
IV. Maintenance of Equipment & Stores	93	4825	0.12	6.47	40.0	86.0	85.8
V. Transportation (Other than Train, Engine and Yard)	37	2148	0.09	5.18	40.0	73.6	73.4
VI. (a) Transportation (Yardmasters, Switch Tenders & Hostlers)	13	349	0.27	7.30	20.6	70.4	69.8
VI. (b) Transportation (Train and Engine Service)	293	8403	0.54	15.38	45.5	61.3	61.0
Grand Total	621	21417	0.21	7.29	44.7	76.1	75.7

Figures compiled by the Interstate Commerce Commission and included in the report of the Committee on Statistics, which was presented by T. H. Carrow, superintendent of safety of the Pennsylvania, showed that the reduction of 46.9 per cent, between 1923 and 1931, in the number of maintenance of way and structures employees of Class I railways killed while on duty per million man-hours worked, was greater than that for any other group of employees except one. The reduction of 68.3 per cent in the number of maintenance of way employees injured per million man-hours and of 67.9 per cent in the total casualty rate of this group, while not making such a favorable comparison, were only slightly below the average for all employees. This information is summarized in Table I in which the employees are divided into seven groups according to departments and the nature of the duties performed.

The Committee on Statistics also presented figures showing the safety standings of the various classes of employees in the maintenance of way department, which are given in Table II. In this table it will be noted that the percentages of decrease, or increase, in the number of employees killed and injured per million man-hours worked in 1931 as compared with 1923, show wide variations as between the different classes of employees. In several of the classifications there was a decrease of 100 per cent in the death rate, while in others there was a considerable increase, which amounted to 181.8 per cent in the case of pumping equipment operators. However, every classification showed a decrease in both the injury and total casualty rates (injuries and deaths combined).

Among individual papers dealing with the safety problem in the maintenance of way department was one presented by Lem Adams, engineer maintenance of way of the Union Pacific System, entitled "Power Apparatus in Maintenance of Way Work," which was illustrated with motion pictures showing the use of the various kinds of power equipment and the ways in which they affect the safety of employees. Another paper, entitled "Planning for Safety in Track Construction" was read by Frank R. Bradford, director of safety and fire protection of the Boston & Maine, in connection with a motion picture called "Rail Laying on the Line of the Minute Man," the operation illustrated in this picture, in which 100-lb. rail was replaced with 130-lb. rail, being that described in detail in the September, 1931, issue of *Railway Engineering and Maintenance*. A third paper, which was read by J. P. Wood, supervisor of bridges and buildings on the Pere Marquette, dealt with the safety problem as applied to the bridge and building gang.

Table II—Casualties to Employees on Duty, Maintenance of Way and Structures Department

Years 1923 and 1931, Class I Railways, Including Large Switching and Terminal Companies

	1923		1931		Rate per million man-hours 1923		Rate per million man-hours 1931		Per cent decrease in rate per million man-hours 1931 under 1923		
	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Total
Roadmasters and general foremen	8	58	4	21	0.95	6.90	0.52	2.76	45.3	60.0	58.2
Assistant general foremen	..	10	..	1	...	12.21	...	1.20	...	90.2	90.2
Supervising maintenance of way inspectors and scale inspectors	..	10	..	3	...	12.59	...	4.03	...	68.0	68.0
Maintenance of way inspectors	1	32	..	8	0.62	19.95	...	5.02	100.0	74.8	75.6
Bridge and building gang foremen (skilled labor)	5	130	3	35	0.36	9.39	0.32	3.75	11.1	60.1	58.3
Bridge and building carpenters	43	2553	12	527	0.75	44.62	0.38	16.59	49.3	62.8	62.6
Bridge and building ironworkers	5	99	2	47	2.07	40.89	0.95	22.25	54.1	45.6	46.0
Bridge and building painters	8	235	3	45	0.95	27.88	1.04	15.54	I 9.5	44.3	42.5
Masons, bricklayers, plasterers and plumbers	..	166	..	30	...	30.49	...	8.14	...	73.3	73.3
Skilled trades helpers	6	676	7	156	0.23	25.50	0.50	11.08	I 117.4	56.5	55.0
Regular apprentices	1	40	..	1	2.50	100.00	...	8.70	100.0	91.3	91.5
Portable steam equipment operators	5	163	3	37	0.81	26.34	0.55	6.78	32.1	74.3	73.0
Portable steam equipment operator helpers	4	86	3	20	1.60	34.50	2.07	13.82	I 29.4	59.9	56.0
Pumping equipment operators	2	138	3	34	0.11	7.40	0.31	3.57	I 181.8	51.8	48.3
Gang foremen (extra gang and work-train laborers)	3	126	2	18	0.25	10.68	0.35	3.19	I 40.0	70.1	67.6
Gang foremen (bridge and building, signal and telegraph laborers)	1	99	..	16	0.57	56.12	...	19.14	100.0	65.9	66.2
Gang or section foremen	33	1027	15	277	0.32	9.80	0.17	3.14	46.9	68.0	67.3
Laborers (extra gang and work train)	52	3181	13	689	0.34	20.62	0.21	11.10	38.2	46.2	46.0
Track and roadway section laborers	276	15994	68	2694	0.52	30.18	0.22	8.55	57.7	71.7	71.4
Maintenance of way laborers (other than track and roadway) and gardeners and farmers	20	806	2	177	0.97	39.09	0.17	14.92	82.5	61.8	62.3
General foremen and supervising inspectors (signal, telegraph, and electrical transmission)	..	20	..	5	...	14.13	...	3.78	...	73.2	73.2
Assistant general foremen (signal, telegraph, and electrical transmission) and signal and telegraph inspectors	1	17	..	6	0.68	11.48	...	3.57	100.0	68.9	70.6
Gang foremen (signal and telegraph skilled trades labor)	1	24	..	3	0.33	7.98	...	0.98	100.0	87.7	88.2
Signalmen and signal maintainers	13	380	8	77	0.64	18.63	0.40	3.88	37.5	79.2	77.8
Linemen and groundmen	6	231	5	89	0.95	36.48	0.90	16.02	5.3	56.1	54.8
Assistant signalmen and assistant signal maintainers	2	94	1	34	0.35	16.25	0.21	7.09	40.0	56.4	56.0
Signalmen and signal maintainer helpers	6	224	4	49	0.77	28.88	0.64	7.83	16.9	72.9	71.4
Total	502	26619	158	5099	0.49	26.03	0.26	8.26	46.9	68.3	67.9

I—Increase.

On the Hocking Division of the Chesapeake & Ohio

Present Day Conditions —

A Challenge to the Roadmaster*

Responsibilities are increased and field of effort is widened by new demands and changing practices

By C. J. GEYER
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FROM the standpoint of the railroads, and particularly the roadmaster, present-day conditions may be resolved into two main aspects. The first of these, of course, is the business depression which has resulted in curtailed allowances for maintenance work with the consequent reduction in the amount of work a roadmaster is able to accomplish. The second aspect is represented in the improvement that has taken place in the art of railroading in general and in maintenance methods in particular, because of influences with which we are all familiar.

The second aspect is by far the more important of the two as the first one will be automatically eliminated by either improved business conditions or by the total failure of the railroads. In so far as the roadmaster's attitude is affected by periods of prosperity or adversity, it seems to me that he should direct his efforts along the same lines in both periods. It is true, however, that in periods of depression it is necessary that he do some things that may be somewhat slighted in periods of prosperity without serious results.

Should Maintain Morale

During periods like the present, it is important that officers of the maintenance of way department do everything in their power to maintain the morale of their subordinates on the highest plane. Through his intimate contact with track foremen and laborers, the roadmaster will, consciously or unconsciouly, exercise a tremendous influence on the morale of this large class of employees. Regardless of how discouraging other conditions may be, a high morale embodying a fixed standard and an ultimate goal will carry any department a long way toward the desired end. Conversely, an unhappy, low-spirited body of men will wreck a maintenance of way department, even though liberal allowances of men and materials are available.

If I were a roadmaster I would bend every effort to establish a high morale among the forces of my department. I would do this by first setting my own house in order. I would study carefully each order, oral or written, given to me by my superior officers, and would endeavor in a whole-hearted way to carry out such orders, not only in the letter but in the spirit in which they were intended. I would endeavor to sense the desires of the management and to show my willingness and desire to meet its wishes. By assuming this attitude the roadmaster is assured of the respect of his superior officers and, being happy and contented in his position, his fellow employees will tend to assimilate the same attitude, even though present adverse conditions make it necessary to do things that are drastic in their effect.

A roadmaster may often receive orders that are not in accord with views which he may have founded on long years of experience. It may be an effort to forego what he thinks is sound practice to adopt a practice that is entirely new and which he may think is entirely wrong. But the roadmaster should bear in mind that the successful management cannot afford to make many

*Abstract of a paper that was presented before the Maintenance of Way Club of Chicago on September 21.

mistakes, and he may be assured that the plan has been developed carefully and is almost certain to be successful if carried out in the proper spirit. With this attitude, he will in time see the wisdom of the new plan and will adopt it as his own.

The roadmaster should never let his subordinates suspect that any plan does not meet with his ideas of propriety, but must support it as if it were his own idea. Roadmasters have been known to say to their subordinates, "I don't think much of the idea, but the big boss says it must be done, so we will have to do it his way." I recall a striking example of how such an attitude defeated the purpose of a plan. Some years ago a high railroad officer issued an order affecting the maintenance of way department, which was opposed by practically every roadmaster and employee in that department. This resulted in the poor execution of the plan, drastic changes in personnel and the ultimate failure of the idea. Some years later almost the identical order was issued on the same railroad and was given the active and enthusiastic support of each officer and employee concerned. The beneficial results were surprising, especially to those who had seen the failure of the same principle when it had been attempted several years before.

Recently I was told of a conversation that took place between two negroes working on a rail-laying gang. One darky was indulging in a constant and monotonous chatter in which he was criticizing everybody and everything that had anything to do with the conditions under which he worked. Finally is buddy became tired of the continual tirade and said, "Look here, nigger, quit that mouth running, it's they railroad, ain't it?" The roadmaster should remember that it is "they railroad," but he can make it his railroad if he is working in a wholehearted and confident manner in carrying out the policies of the company. Under present conditions it is absolutely necessary that a roadmaster maintain a high morale among the employees under his jurisdiction.

A Definite Program Necessary

Now, as never before, the roadmaster must conduct his work according to a fixed program and in compliance with a definite standard. He knows what work should be done and when it should be done, and, further, he knows within reasonable limits the labor and material allowances that will be available. It is not sufficient to make only general plans for the execution of this work, but a written program should be prepared, outlining in considerable detail all work to be done and the date on which it is planned to do the work.

In preparing this program the roadmaster should give first consideration to the time of year most favorable for the major operations, such as rail, tie and ballast renewals, ditching and roadbed repairs and track surfacing. Other jobs should be fitted into their places, building the program around the bigger undertakings. This program should include every job that it is planned to undertake in the entire calendar year.

After this plan has been worked out in detail to the satisfaction of the roadmaster, he should give each foreman a copy of that part affecting his particular territory, talking over this part of the plan until it is thoroughly understood by the foreman. After each foreman has his part of the plan fixed in his mind he will follow it without trouble and the roadmaster can check his progress very quickly and also determine the efficiency of each gang.

I have referred to the fact that the roadmaster must adhere to a definite standard as well as to a fixed program. In this I have in mind the practical application of the standards fixed by the management. Nearly all of the railroads have complete standard plans for all units that make up the track structure and the roadbed. Although these plans may be in the hands of the roadmaster and his foremen, they are not always trained in reading plans and building in accordance with them. They have trouble in doing the job so that the finished product will have the proper appearance, and will perform the service for which it was intended by the management.

Because of the fact that roadmasters on the same railroad are scattered widely, permitting only limited contact between them, it is not surprising that finished work, which was supposed to have been done in accordance with a standard plan, has no resemblance to that plan, and that a piece of work that is carried out under one supervisor or foreman may actually differ in important respects from a similar job that is done under another supervisor or foreman. This fault is not confined to roadmasters only, but may even be found among division engineers or higher officers.

Because of this human weakness of looking at a picture and getting different impressions of its appearance and meaning, I would, if I were a roadmaster, set up at least one mile of typical track on my territory as near the standard plan as is possible. I would be sure that I had interpreted the standard plans properly by getting the approval of my superior officer on this standard mile. This mile of track would then be the goal toward which every trackman on the subdivision would work. It would be seen almost every day by the roadmaster and frequently by the foremen in the territory and in this way they could not fail to notice the details in regard to which they were falling short of the standard plan. I feel sure that this method will go far toward assuring the roadmaster and his foremen of success in their work, and it is my belief that if every roadmaster checked his work against the standard plans he would be surprised to perceive in how many instances he is not adhering to the standard issued by the management. He may also find that a strict adherence to the standards may develop weaknesses in that plan which had not previously been apparent because of his failure to follow the plan strictly.

Must Watch Costs Closely

It is always proper to perform work in an economical manner, regardless of how liberal an allowance may be. At the present time, moreover, allowances are strictly limited and the roadmaster must make every dollar go as far as possible in order to perform all necessary work. He must, therefore, know the cost of each job. By this I do not mean the average cost of each class of work in his entire territory, but the cost of each job as performed by each gang. I was impressed by a report that was published recently by Sir Joshua Stamp, chairman of the board of the London, Midland & Scottish Railway in England, in connection with the consolidation and reorganization of that road with other lines. In speaking of costs in the mechanical department, he said, "It is not sufficient to know the average cost of repairing locomotives, or even the average cost of repairing each individual locomotive. We must know the cost of each unit of repairs on each engine in each shop."

The roadmaster should determine the cost of each job that is performed by each force on his territory, because even though he may know the average cost of performing a certain job for his entire territory, he may not detect a costly operation in connection with that job as

performed by a certain gang. However, when the costs are broken down and he finds that Foreman Bill Jones is laying rail for $3.50 per ton, that foreman Tom Smith is laying rail at a cost of $4.00 per ton, and that the average on the entire territory is $3.75 per ton, he will first observe the performance of Bills Jones' gang, studying all details in order to determine how he is doing the job at a lower cost. The roadmaster will then observe the performance of Tom Smith's gang in order to detect the reason for his excess cost. He may find that Bill Jones has stumbled onto some efficient method of doing some particular part of the job, in which case he will disseminate this knowledge among all his foremen; or he may find that Tom Smith has failed to carry out a well-known and efficient method of doing this work. In either event he has found a leak, and by stopping it he will be able to increase the output of the gangs under his jurisdiction without an increase in his allowance.

Safety a Factor in Costs

The prevention of accidents to employees as a factor in costs has been given serious consideration on every railroad in the United States with considerable benefit. I do not refer to the humane side of this movement but to the effect or personal injuries to the employees on costs in the maintenance of way department. There may not be a special place where this cost is recorded, but just as certainly as a damaged motor-car or truck machine is charged against the efficiency of the maintenance of way unit in which the damage occurred, so is the cost of service given an injured man and the expense of training another to take his place charged against the foreman under whom the injury was sustained. It has been my observation that the majority of personal injuries are the result of practices rather than defects in the physical plant, and a large portion of the accidents are caused by carelessness.

If an employee is injured by the careless loading or unloading of the track motor car while on the way to work in the morning, valuable time is lost by the entire gang while taking care of the injured man, and, further, their productive output for the entire day is affected adversely. A brief inspection mixed with a little common sense on the part of the foreman will prevent many accidents of this nature and save money for the department, which may be spent on a further expansion of the program. To a great extent the roadmaster has the control of accident prevention in his hands. By his own conduct and after a few simple instructions to his foremen, he can reduce materially the personal injuries in his department and thereby greatly increase the amount of productive work.

Out-of-Face Vs. Spot Renewals

There is one aspect of maintenance work that I think is particularly important at this time and regarding which I have heard little discussion, and that is the relative merits of the out-of-face and spot methods of making renewals. Several years ago John V. Neubert [chief engineer maintenance of way, New York Central Lines] was discussing maintenance conditions and practices on the railroads of Europe at a session of the Roadmasters' and Maintenance of Way Association. Mr. Neubert made two remarks that struck me as worthy of considerable study. He did not connect the two remarks in any way and I do not know whether or not he intended to do this, but I thought the two went together. He remarked that the European railways generally followed the plan of out-of-face renewals in the prosecution of maintenance work, renewing in some instances the entire track structure above the subgrade over an entire division. Later during his discussion Mr. Neubert remarked that, as a whole, the European railways were not as well maintained as the railways of the United States.

Our railways, to a great or lesser extent, are maintained by the spot-renewal method, and in my opinion this is one reason why they appear to be better maintained. It is also my opinion that our railways have about reached a state of development where it is practicable to make spot renewals to a greater degree than has been practiced heretofore. This means that the roadmaster must so develop his program and plan his organization that he will work over every foot of his territory in each calendar year, making only renewals and repairs where the facilities would not otherwise perform their function properly during that year.

Using this method, the ultimate result is a railroad that is similar in condition at all points, instead of good, medium and bad, which would be the case if the out-of-face method were used. It may be possible that some roadmasters' territories are not yet ready for this complete spot method, but, if I were a roadmaster, I would certainly work toward that end in so far as I found it possible to do so.

The subjects that I have attempted to cover in a general way are applicable, in my opinion, regardless of conditions, but I think it is particularly necessary to follow these principles during times when the available maintenance allowance must be stretched to its ultimate capacity to cover the work that must be done. Furthermore, I think these principles are also necessary to meet the changes in business methods generally, and particularly the developments that are taking place so rapidly in maintenance methods.

Dirt on Track Causes Derailment at Highway Crossing

THE derailment of a passenger train at a grade crossing on the Central of Georgia on June 2, which led to the death of the engineman and the injury of the fireman, resulted from the fouling of the track by dirt that had been deposited on the rails by a road grader, according to a report on the accident by the Bureau of Safety of the Interstate Commerce Commission. The following information is taken from this report.

The accident occurred at Girard, Ala., at a highway crossing that intersects the single-track line diagonally on an 8-deg. curve. The highway is descending toward the track from both directions and consists of a gravel and clay mixture covered with a surface layer of loose dirt. The crossing is not planked. The train, consisting of a locomotive, a mail and baggage car, and three coaches, was derailed at the crossing while traveling at a speed estimated to have been between 6 and 20 miles an hour, the engine being derailed and turned bottom side up.

The accident occurred at about 11:30 a. m. and the evidence showed that between 7 and 8 a. m. a road grader had passed over the crossing with the blade down. After the derailment an inspection of the crossing showed loose dirt piled over the high rail to a depth of three inches and for a distance of about three feet, through which the wheels of the engine had passed. Marks on the rails and ties indicated that the derailment took place at this point.

Floating Swing Spans for Railroad Bridges

REFERENCES to channel openings in bridges across navigable streams are commonly associated with some form of movable span, but it is of interest to note that the demands of river traffic at two railway bridges in the United States are fulfilled by a form of structure that bears almost no resemblance to the usual movable span—namely, the pontoon. Both bridges cross the Mississippi river and both belong to the same railway, the Chicago, Milwaukee, St. Paul & Pacific. One, between Wabasha, Minn., and Trevino, Wis., has a pontoon 396 ft. long, and the other between Marquette, Iowa and Prairie du Chien, Wis., where the government maintains two channels, has a pontoon for each, one near the Iowa side 274 ft. long and the other near the Wisconsin bank 209 ft. 4 in. long. Until 1925, the Milwaukee had a fourth structure of this type in a crossing of the Missouri river at Chamberlain, S. D.

While these structures are in a class by themselves, the only other known example on the American continent being in a crossing of the canal at Paraiso, Panama for a spur of the Panama railway, they have a long history, for pontoons have been in service at Prairie du Chien since 1878 and were antedated by one in a crossing of Lake Champlain at Rouses Point, N. Y., that was built for the Vermont & Canada (Central Vermont) in 1851.

Have Given Satisfactory Service

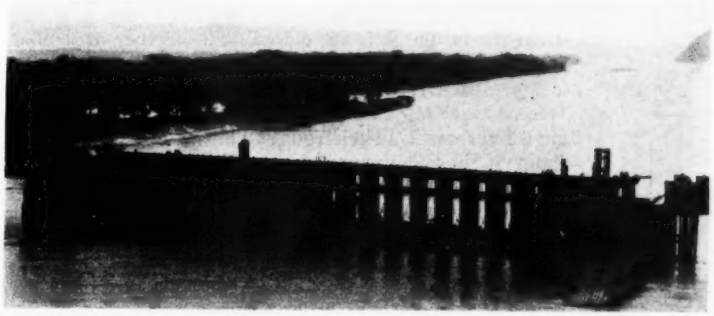
The fact that the four Milwaukee channel openings have been maintained with structures of this class for an aggregate service period of 202 years without a single accident for which the structure or any part of it was responsible, is evidence of their thoroughly practical character and entire safety in locations of moderate waterway and railway traffic. This statement is made with due recognition of the limitations of the pontoon. It imposes restrictions on the speed of trains and its movement in opening and closing the waterway is somewhat slower than that of movable bridge spans but where these disadvantages impose no serious restriction on rail and water traffic their lower cost has warranted their continued use on the two branch lines of the Milwaukee.

The pontoon as it has been developed for use in these railway bridges, embodies a structure that must fulfill four elemental requirements. It must be capable of supporting the heaviest train loading handled on the bridge. It must be stable under load in the face of water, wind and currents. It must be equipped with adequate facilities for movement to open and close the channel and with suitable devices for locking it in alinement with the bridge. It must provide for a ready adjustment of the distance between track level and water level with changes in the stage of the river, and it must provide the necessary means of overcoming the variation between the track level on the flanking fixed bridge structure and the track level on the pontoon that occurs with the passage of every train, since the pontoon necessarily rides lower in the water under load than it does when light.

Credit for the development of a structure to meet these conditions must be given to John Lawler, one-time freight agent for the Milwaukee at Prairie du Chien, and those who assisted him in building the original bridge across the Mississippi river between Prairie du Chien and North McGregor (now Marquette), for while marked improvements and greater strength have been embodied in the newer pontoons built when the older ones had to be renewed, the basic design has not been changed. The load-carrying feature is a barge, stiffened for the longitudinal distribution of the live load by means of heavy longitudinal bulkheads. In pontoons built to replace old ones at Prairie du Chien in 1914 and at Marquette in 1916, the bulkheads were supplemented by four Howe trusses built with web members passing through the deck to connections with bottom chords resting on the lower members of the barge frames. However, in the last pontoon to be built, a new one placed in service in January at Wabasha, no trusses were provided, dependence being placed on five longitudinal bulkheads 18 in. thick and the stiffening effect of the heavy top and bottom planking. Development of adequate bending resistance on the part of the bulkheads, which

The Pontoon as Seen from the Track Level—Apron Span in the Foreground

An account of the construction, operation and maintenance of pontoons in two river crossings of the C. M. St. P. & P.



Above—On the Deck of the Pontoon. Note the Blocking for the Adjustment of the Bridge-Deck Level. At Left—A General View of the Pontoon at Marquette, Iowa

consist of 10-in. by 18-in. and 8-in. by 18-in. timbers laid flat one on another, is dependent very largely on the success attained in resisting slipping on the horizontal contact surfaces between timbers resulting from horizontal sheer. This is opposed by dowels and by steel shear rings that are imbedded in the adjoining faces of the timbers. This obviously calls for very careful framing.

How the Track Floor is Supported

The track is supported on a bridge floor of wooden stringers bearing on steel floor beams which rest at their ends on tiers of wooden blocks that bear on the deck of the barge directly over the bulkheads. These tiers of blocks are supported against lateral displacement by groups of four 8-in. by 10-in. guide posts that also resist longitudinal and lateral displacement of the bridge floor. In the pontoons provided with Howe trusses, these posts serve also as the verticals in two of the trusses.

As the elevation of the bridge floor relative to the deck of the barge is raised or lowered by adding or removing blocks, means must be provided for lifting the bridge floor clear of the blocks. In two of the pontoons this consists of portable jacks applied by means of struts to the bottoms of the floor beams. In the case of the Marquette pontoon, however, the entire floor is lifted simultaneously by means of wire rope tackle from drums on two motor-operated shafts extending the entire length of the barge just above the deck.

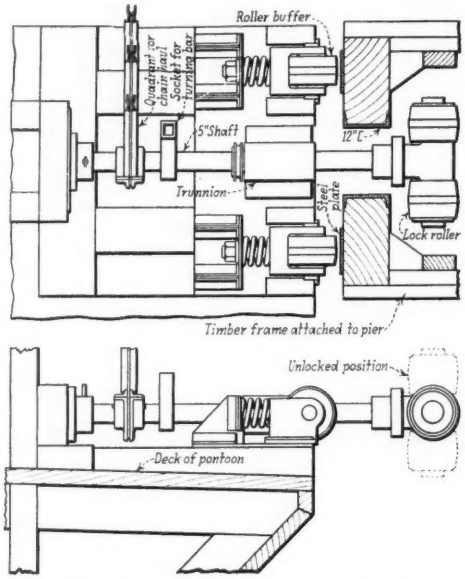
It would, of course, be entirely impracticable to adjust the level of the track on the pontoon to coincide exactly with that on the adjoining structure for the reason that the pontoon not only settles as much as 17 in. under the weight of an engine and by smaller amounts for lighter equipment, but also lifts up at one end as a train passes on to it or leaves it at the opposite end. For this reason an apron or hinge span is provided in the track floor at each end, which consists of a plate girder span from 40 to 50 ft. long that is supported on the pontoon at its inner end and rests on the adjacent pier at its outer end. This affords the necessary ramp to compensate for these differences in elevation. The effect of this is clearly shown in the track view, the blocking for the track level being so arranged that the track on the pontoon is cocked up several inches when the structure is unloaded. These apron spans also perform a necessary function in providing for the minor variations in track alinement which attend the slight rolling and swinging effect that cannot be avoided in any structure that floats on water subject to wave action. This is not a serious matter with the pontoons now in service, which are remarkably steady in all weather. This is credited largely to the greater width of the present pontoons at Marquette and Prairie du Chien, 56 ft., the older ones having been 48 ft. wide. As a consequence suspension of traffic during severe storms or heavy ice flows, which was formerly a not infrequent occurrence, is now very rare at this crossing. The Wabasha pontoon whch serves a minor branch line is 50 ft. wide.

Other Parts of Ordinary Construction

The remaining portions of the river crossings of which these pontoons form an important part are of ordinary construction, embracing pile trestles, and steel girder and truss spans on either masonry or pile piers. The substructure adjacent to the floating span consists of pile piers in all cases because that type of construction can be made to meet the special requirements imposed for the least money.

The pontoons are opened for river traffic by swinging like a door on a hinge, the hinge in this case consisting

of a steel pile braced to the downstream corner of the adjacent pile pier by means of a series of steel straps, the pontoon being swung from the pile by means of a hinge plate that is attached to frames of the barge. The steel straps are removable so that any of them can be taken off to avoid fouling the hinge plate as the water stage changes. The moving machinery consists of a two-cylinder horizontal steam engine that drives a specially constructed winch head around which several wraps are taken with a 1¼-in. steel chain, which lies in the channel in a diagonal direction in approximately the path of the swinging end of the pontoon with its end secured to anchor piles driven in the river bed. Thus, the turning of the winch head in one direction hauls the end of the



A Sketch of the Lock at the Swinging End

pontoon in one direction and vice versa. The engine and boiler are housed on the deck of the pontoon near its swinging end, or on a separate barge attached to it. On the Marquette pontoon the boiler also supplies steam to a turbine-generator set that furnishes current for the motors that operates the bridge-floor lifting hoists.

The Locking Mechanism

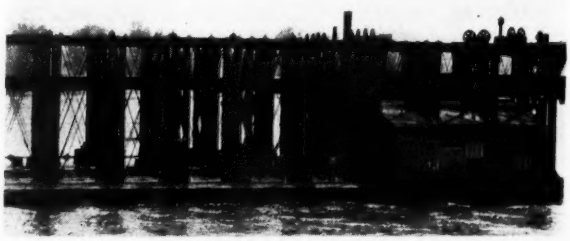
The design of a bridge lock that would be effectve in spite of changes in river stage was a difficult problem, but through a process of trial and error a practical device was developed that is simple but effective. As the pontoon is brought into the closed position the upstream side is brought into bearing near its end with a wing extending a short distance toward the channel from the face of the adjacent bridge pier, spring buffers being provided at the point of contact to ease the impact. The problem then is to provide means for holding the barge and this pier projection together at this point of contact, with the imposed condition that the lock provided must be effective at all stages of the river. On the face of this pier projection are two 12-in. by 24-in. timbers set vertically about 12 in. apart, against which two spring buffers attached to the barge are in bearing. The lock consists of a massive steel "T" mounted on the barge with the "stem" supported in bearings in a horizontal position at right angles to the bridge and with the "cross" extending beyond the upstream face of the barge. A hand lever attached to the stem provides means for turning the "T" through an angle of 90 deg. about the axis of the stem, that is, so that the cross of the "T" may be placed in either a vertical or horizontal position. If in the former, when the pontoon is brought to the closed position the cross of the "T" will pass between the two upright timbers and if it is then quickly turned 90 deg. the two halves of the cross will bear on the rear faces of the two timbers, thus locking the pontoon.

The outer ends of the hinge or apron girders, which have rocker bearings on the piers, are raised and lowered by means of a cable and sheave rig by the aid of power hoists. Provision is made for raising and lowering the girders also by means of jacks with the aid of blocking (like that used to change the elevation of the bridge floor) in the event of failure of the power hoist.

Mitered Rail Joints

Mitered rail joints are provided at each end of the pontoon, the miters being cut in the same direction on both rails so that, with the apron spans raised by an amount that is not enough for the rails on the pontoon to clear those on the approaches, the bottoms of the pontoon rails will come in contact with the approach rails when the bridge is being closed. The former are spiked fast to the ties, but the latter are not spiked for some distance back from the face of the pier so that they are free to move laterally on slide plates while being held to gage by several switch rods. This is necessary on account of the momentary overtravel of the pontoon when being closed. A cable attached to the rails on the approach and passing over a pulley to a counterweight on the downstream side of the bridge keeps the approach rails in contact with the pontoon rails at the miters.

Operation over the bridge is controlled by hand signals and a permanent order requiring all trains to stop short of the pontoon unless given a proceed signal. Accordingly, the first step in opening the bridge is to set a red flag on each approach, following which the aprons are lifted, the lock is thrown and the operation of the chain-winding engine is started. Closing the bridge involves the same function in reverse order, and the last step, that of lowering the apron spans, is a matter of some manipulation during stormy weather, owing to a certain degree of rolling and pitching of the barge that makes it difficult to get the end of the hinge girders spotted in exactly the right position. Two men are required to handle the bridge, one to operate the hoists and hauling engine and the other to handle the bridge lock and the end lifts in turn and to pass the start and stop signals to the man in the engine room.

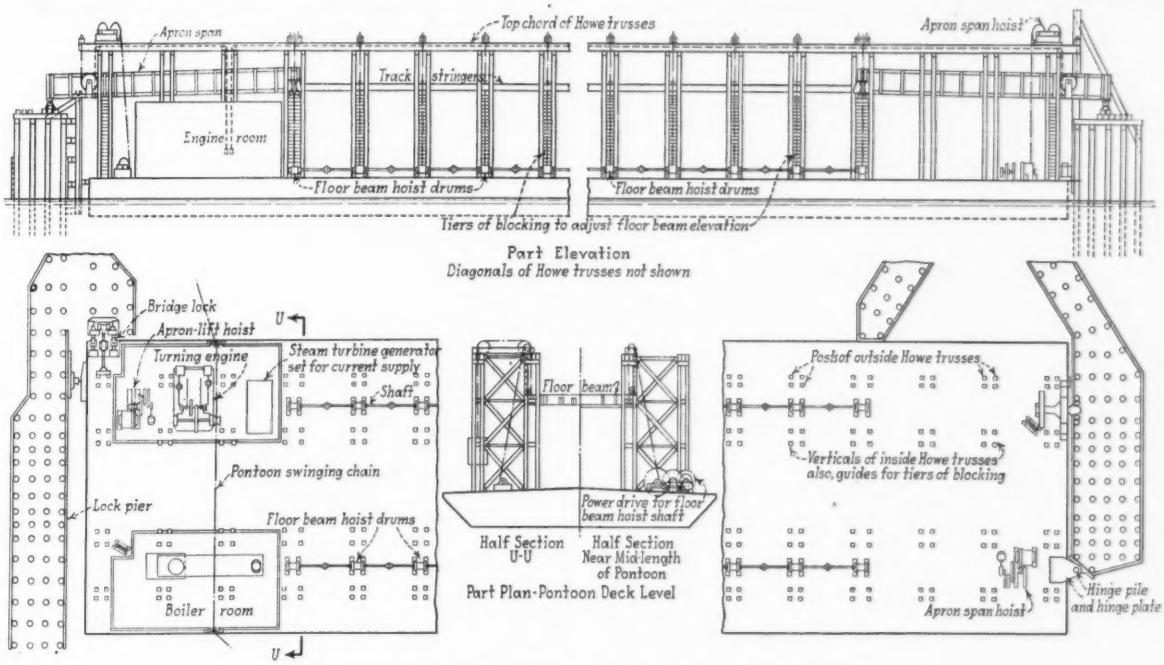


Swinging End of a Pontoon Showing the Engine Room

It requires the services of two men also, to make the change in the level of the track floor, whether this is done by jacking or by the hoisting equipment provided on the Marquette pontoon. The latter eliminates the laborious jacking and except for the few seconds required to raise and lower the track floor, the time required is that consumed in changing the blocking, a mat-

ter of about 10 min., compared with an hour or more where each floor beam is jacked up in turn by hand. The time required to adjust the blocking has been greatly expedited by a clever expedient developed years ago by one of the bridge tenders. As seen in the photograph taken from the deck of the barge, the tiers of blocking during periods of low water are so high that if the change in the blocks had to be made under the floor beams at the tops of the piles it would be necessary to provide staging for the men and they would have to lift and lower the blocks from and to the deck. To avoid this, light chains hung from each floor beam are attached to a steel bar passed between the blocks at about waist height from the deck, so that as the floor beam is raised all the blocks above the bar are raised with it, thus opening a gap for removing or adding blocks at a convenient working height above the deck.

The maintenance of a pontoon bridge corresponds with that of a barge on the one hand and of a frame trestle or Howe truss span on the other. The maintenance of the barge is confined primarily to recalking of the deck and bottom planks. A small dry-dock box has been devised for calking the sides and edges of the bottom, but no satisfactory means has been developed for repairs to the bottom short of placing the pontoon in a dry dock, but ordinarily this has not been warranted within the economical life of the pontoons, which in the earlier ones built of untreated wood was about 15 years.



General Part Plan and Elevation of the Pontoon at Marquette, Iowa

The Bridge Tenders

The force required to operate a pontoon consists of two men for each of three shifts during the navigation season. During the closed season the force is reduced to 4 men, two in the daylight shift and one for each of the night shifts. A winter force is required because it is necessary to maintain the proper elevation of the track with changes in water level as in the open season, changes being made during the day shift or while two men are on the pontoon when the shifts change at night. The pontoons at Prairie du Chien and Marquette are designed to take care of a variation of 17 ft. in water stage. For extreme stages, up to 22½ ft. maximum, it is necessary to raise the decks on the approaches. Ordinarily, the changes in water level take place slowly, the most rapid rise being 18 in. in one night while the extreme rate of fall is about 12 in. in 24 hours. Added to these duties is the responsibility of the bridge tenders to protect the pontoon from ice jams, opening the bridge when necessary to release an accumulation of ice. The planking on the upstream side of the barge is protected against ice abrasion by steel sheathing.

New pontoons built at Prairie du Chien and Marquette in 1914 and 1916, respectively, of creosoted timber, will develop a much longer life as they are now in excellent condition after 18 and 16 years servce, respectively. Still greater life is expected of the pontoon at Wabasha, because of refinements in treating practice and because all timbers were not only framed before treatment but in all cases where shrinkage after framing would have introduced inaccuracies of fit, the timbers were preseasoned by the Boulton process before framing.

Typical Gravel-Ballasted Track on the Denver & Rio Grande Western

What's the Answer?

Have you a question you would like to have someone answer?

Can you answer any of the questions listed in the box?

To Be Answered in January

1. What methods should be employed and what Is there any advantage in the use of track liners sequence should be followed in lining a turnout? for this purpose?

2. When a timber trestle is built across a waterway where rock is too near the surface to permit the use of pile bents, what is the most satisfactory method of anchoring the mud sills against movement, to insure the safety of the structure?

3. To what relative standard, as compared to main-line tracks, should passing sidings be maintained?

4. What provisions should be made for heating pumping stations that are operated automatically or at infrequent intervals? What type of heating plant is most satisfactory?

5. Into how many classifications should released rail be separated? Why and for what purposes?

6. What are the advantages of an annual inspection of buildings? By whom should it be made? Should it be made in the fall or in the spring? Why?

7. What action, if any, can section forces take to eliminate or minimize the breakage of angle bars?

8. What are the relative merits of boiled and raw linseed oils for painting wood and steel surfaces?

Protecting Pipe Lines

Under what conditions should underground pipe lines be protected against corrosion? What means can be employed ?

This Is a Subject of Major Importance

By Engineer of Water Service

Although this is a subject that has been under consideration for many years, it is estimated that the average service life of pipe lines in railway service is only 70 per cent of their potential life. There can be only two reasons for this. Either the methods of protection in use are not effective or they are not being used to the extent that they should. As an indication of the importance of this subject, the railways have in service a total of 18,000 miles of cast iron pipe and nearly 21,000 miles of wrought iron and steel pipe.

Corrosion takes place only in the presence of moisture; a dry surface never rusts. For this reason, all efforts to provide protection against corrosion should be directed toward excluding moisture. On the other hand, some impervious clays which have no alkali content, retard corrosion to the extent that it is generally considered unnecessary to provide any special form of protection. In fact, a coating of from six inches to a foot of such clay has been known to protect pipe lines that were laid through cinder fills.

When considering special measures to protect pipe lines against corrosion, it should be borne in mind that a method which has been successful under one set of conditions may fail completely under another. In other words, a hot water or steam line requires different treatment from that which should be applied to a cold water or an air line. A line that is subject to wide or rapid fluctuations in temperature requires different materials and methods than one in which the temperature is nearly constant.

In one case elasticity is of first importance in the protective coating. In another it may be resistance to abrasion. In still other cases, resistance to heat, to the solvent action of water or to the attack of alkali or acid may be the prime requisite. Two requirements are common, however, to all materials that are to be used for protective purposes—they must adhere to the pipe under all conditions, presenting an unbroken surface or the effort is doomed to failure, and they must be completely inert to the metal in the pipe.

Ordinary oil paints are useless on underground lines, although they can often be used to advantage above ground. Tar and asphalt compounds, such as are used on cast iron pipe, are effective under many conditions. Certain non-hardening coatings which are on the market have given excellent results in both acid and alkali soils, except for hot water and steam lines. If the importance of the line or lines warrants the expense, encasement in concrete can sometimes be employed to advantage, except in alkali or highly acid soils.

Another method that is now being employed with increasing frequency is to coat the pipe with some satisfactory protective material and then enclose it in a clay-tile conduit. One essential of this method is that the conduit shall be properly graded to drain away any water that may seep into it.

Wherever it is practicable to do so, pipe lines should be constructed above ground, where they are easy of access for inspection or repair, and where the difficulties of providing protection against corrosion are reduced to

a minimum. When an underground line is abandoned, it is seldom salvaged unless it is of large size, but a line that is above ground can be salvaged at a minimum of expense regardless of the size.

Wherever Corrosion Is Severe

By G. M. HELMIG

Bridge and Building Department, Missouri, Pacific, Wynne, Ark.

Underground pipe lines should be protected wherever they are exposed to severe corrosive influences, the worst conditions generally being in alkali soils across salt marshes and in cinders from smelters and locomotives. Corrosive activity in alkali soils is often so intensive that it is not uncommon for both plain and galvanized pipe to be destroyed in the space of two years. Many instances have also come under my observation where the life of similar pipe was equally short when laid in locomotive cinders or slag from non-ferrous smelters.

Cast iron, on the other hand, withstands corrosion to a much greater degree, so that, if the diameter of the line is large enough to bring it within the range of cast iron pipe sizes, such pipe can often be used to advantage. If it is not practicable to use cast iron, then definite steps should be taken to provide adequate protection.

Several types of protection can be employed, depending on the condition to be encountered. In some instances, where ground-water seepage does not occur, all that is necessary is to protect the pipe from contact with the moist earth or cinders. This can often be done by enclosing it in a creosoted wooden conduit. If there is considerable water, a coating of tar and asphalt similar to that used on cast iron pipe may be effective in soils that do not contain alkali. If the line is of sufficient importance or where there are several lines, a well-drained concrete or clay-tile conduit, or encasement in concrete will give added protection. Concrete should not be used in alkali soils, however.

The use of wooden pipe wound with wire or strap bands should be discouraged, since the alkali attacks the metal and failure usually occurs in a short time.

Maintaining Line on Trestles

What is the most satisfactory method of maintaining line on a pile or timber trestle ?

Depends on the Design of the Trestle

By H. AUSTILL

Bridge Engineer, Mobile & Ohio, St. Louis, Mo.

To a great extent the answer to this question depends upon the design of the trestle. Much damage, and even destruction, of timber has resulted from the customary practice of using drift bolts for fastening the stringers to the caps. Where this method of fastening is used, lining, which requires that the stringers be shifted, makes it necessary to gouge out sufficient timber from the top of the stringer to get a grip on the drift bolts with a claw bar, which is the tool most generally used for this purpose. Often, additional damage is done by sticking a pinch bar into the top of the cap in the effort to move the stringers.

In general, the necessity for lining a trestle arises from some movement in the bents, either by reason of the settlement of some of the piling, or insufficient bracing. It is obvious that correction of the trouble at its source should be given due consideration. First consideration then should be directed toward having the bents stable so that the rail does not shift from its original alinement because of lateral movement of the bents. Often the tightening or refastening of the braces is sufficient to prevent this lateral movement.

Unless the alinement is very poor, it is preferable not to disturb the stringers, but to shift the rail on the ties or the ties on the stringers. One design that will permit the ties to be shifted is simple and inexpensive. In this method every fourth or fifth tie is dapped over the stringers and the guard fastenings are omitted from these ties. One intermediate undapped tie is fastened to the stringers by means of a boat spike or a lag screw. To shift the track slightly, the track spikes are pulled from the dapped, or key, ties and the boat spikes or wood screws are removed from the intermediate ties. The entire deck, except the key ties, can then be shifted on the stringers by means of lining bars.

To avoid the use of drift bolts through the stringers or caps, cast lugs may be used. These should be designed to serve as spacers, or packing spools, through which the packing bolts are inserted horizontally, and each one should have a vertical leg that can be fastened to the side of the cap by means of a bolt or lag screw. If it is desired to shift the stringers it is only necessary to remove these fastenings. Another method I have used with success consists of placing an angle iron on top of the cap with one leg lagged to the cap and the other to the stringer.

Establishes Permanent Points in Line

By R. H. GILKEY

Division Engineer, Central of Georgia, Savannah, Ga.

While I assume that this question was intended to refer primarily to the methods of maintenance which should be followed to insure the retention of a correct alinement across timber trestles, I have particularly in mind a practice which will enable the bridge men to obtain this alinement with a minimum of effort. Although a well-built and properly-braced trestle does not get out of line easily, all trestles develop some variations after they have been in service for some time.

For this reason I have found it to be a satisfactory practice to run the correct alinement with a transit and establish permanent points on or near each abutment. If the bridge is short, the foreman can stretch a string between the two points and thus obtain the true line. If the trestle is long, intermediate points should be established at frequent intervals on the ground below the structure. As needed, these points can then be carried to the track level by means of a plumb bob.

Stiff Bents Eliminate Much Trouble with Line

By L. G. BYRD

Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

A primary requisite for holding the line on trestles is to have the bents stiff and well braced against both lateral and longitudinal movement. Assuming that the foundation is of a character to eliminate probability of settlement, that the cross level is perfect or the superelevation is uniform, and that a proper method of attaching the stringers to the caps has been employed, more than 90 per cent of the reasons for irregular alinement on any trestle are eliminated and little effort is required to hold the track in line.

As a result of long experience in maintaining trestles, I prefer to use a ⅝-in. boat spike in each end of every fourth tie on tangent and in alternate ties on curves.

These spikes should be of sufficient length to penetrate at least 3½ in. into the stringers. If the trestle has been constructed as outlined, it will seldom be necessary to line the track as long as the bolts used in assembling and bracing the structure are kept tight.

Six Essentials Must Be Considered

By W. J. HOWSE
Bridge & Building Foreman, New Orleans & North Eastern, Poplarville, Miss.

To maintain a satisfactory line on a pile or timber trestle, six essentials must be given consideration: (1) The bents should be constructed so that there will be a minimum of deflection and of lateral movement under live loads; (2) stringers should not be allowed to get soft at points of bearing or of maximum stress; (3) ties should be sound and provide a uniform bearing for the rail; (4) careful attention should be directed toward assuring accuracy of gage and (5) smoothness of the surface; and (6) guardrail timbers should be bolted tightly to the ties.

Assuming that these requisites have been met, the method of lining is determined by the type of deck. If all of the ties are dapped over the stringers, it is more practicable and less damaging to the timbers to move the deck than to spike line. The latter method damages and eventually destroys the ties. Where it is necessary, however, the old spike holes should be treated with hot creosote and filled with creosoted tie plugs. Where key ties are used, it is better to shift the track and not disturb the deck. It might be possible but is quite improbable that satisfactory line can be maintained on wooden trestles without meeting these requisites.

Inspecting Ties

When inspecting ties, what details are to be noted as indicating that a tie should be renewed the following season? Who should make the inspection? Should it be checked! If so, by whom ?

Good Judgment Is Required

By J. J. HESS
General Roadmaster, Great Northern, Seattle, Wash.

Since it is an economic axiom that no tie should be replaced which will serve effectively for another year, the matter of proper inspection assumes an importance that is not always recognized. Unfortunately, not all maintenance officers are agreed as to what constitutes a proper inspection. Obviously, a tie that is badly rotted, spike cut or worn to the point of destruction does not offer the proper degree of vertical or lateral support for the rail and should come out. The same is true of shattered, badly split or broken ties. Beyond this, however, there is ample room for honest difference of opinion.

It often occurs that ties which present a good surface appearance have vital defects which make them unfit for further use. On the other hand, where surface indications point to excessive decay or shattering it may be found that the body of the tie is sound and will last several years. For these reasons a close investigation should be made of every questionable tie, and no tie should ever be passed over with a casual glance. In other words, a proper inspection requires close attention and the exercise of good judgment based on experience and a reasonable knowledge of timber.

On our road the district roadmaster accompanies each section and yard foreman during the tie inspection, sounding all questionable ties. They examine both ends and the center of every tie, picking the ballast from the sides and ends of those that are doubtful. All ties that are thus slated for replacement are stamped to indicate that they are to be removed.

After this inspection is finished, division and general officers check enough miles on each district to satisfy themselves that good judgment has been exercised.

This Is a Most Important Subject

By W. H. SPARKS
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

When one considers that ties constitute the largest single item of maintenance, he begins to realize that the proper inspection for replacement is a matter that cannot be stressed too much or too often. For this reason, a tie inspector, whether he be a section foreman, a supervisor or a person specially assigned, should be a man of experience and good judgment and having a reasonable knowledge of timber. Furthermore, every inspection should be checked carefully to insure that good judgment has actually been exercised.

Assuming that the inspector is responsible and experienced, the details that he notes as indicating the necessity for replacement and his interpretation of these details provide the key to the whole matter of economy or waste in tie renewals, so that the question as it is put goes directly to the heart of the matter. Formerly, the railways were somewhat careless about the quality of the timber from which the ties were made and, as a consequence, many inferior ties were installed. Likewise, maintenance standards were lower so that the ties were not always well cared for after they were in the track. Inferior ballast, poor drainage, rail cutting, excessive spiking in an effort to hold gage, creeping rails and poor timber, all combined to cause a high rate of failure. The relatively low cost of ties, the ease with which they could be obtained and the lack of close attention to this important phase of maintenance on the part of many supervisory officers bred indifference among section foremen with respect to the economic value of ties. The result was that the custom grew up on practically every railway of removing many ties that could have remained in service for two or three years. This custom, like all others that have become established, has been difficult to eradicate and is one of the basic reasons why a proper tie inspection assumes so much importance from an economic standpoint.

Good tie inspection begins with the receipt of the ties and should include a selection of the timber that is best suited to fulfill the conditions it must meet and a careful follow-up to insure that the ties are well taken care of during their service life.

During the annual inspection, the ties should be examined closely to detect hidden defects that will render them unfit for further service. Often a tie that could be left for another year if on tangent must be removed from a curve. Broken ties, those that are badly split, shattered, spike cut or decayed under the rail should be removed. Decay at the ends or on the sides may or may not necessitate removal; here the inspector must exercise his judgment. Decay of consequence at the bottom almost always necessitates replacement. Ties that are rounded at the bottom or badly damaged from tamping may provide insufficient bearing and, therefore, require replacement, although they may contain more sound wood than others that can be allowed to remain. Every inspection report should contain a statement of the

general causes of failure, and an effort should be made the following year to correct or overcome as many of these causes as is practicable.

No one knows better than the section foreman what the condition of his ties is or the conditions surrounding their maintenance. The next best informed man, who has an equal responsibility with respect to safety and economy, is the supervisor. For these reasons, the section foreman and the supervisor, both of whom must, of necessity, have a working knowledge of timber, should make the inspection. All ties should be given close attention and any that are doubtful should be investigated by opening up the ballast or by sounding. Even with the most careful scrutiny, however, some mistakes will be made, so that the inspection should be continued during the season of renewals to insure that all failed ties are removed.

On this road we are strong in the belief that tie inspection should be checked. After all the data for a division have been assembled the general tie and timber agent, the division engineer and the general inspector of track, accompanied by the respective supervisors, spend one or more days, as necessary, walking over each supervisor's district, checking a mile here and there. By these methods we have improved our tie condition, brought about a reasonable uniformity of replacements and have aroused the interest of both supervisors and foremen.

[Six additional answers to this question were received, which could not be published because of space limitations, as follows: R. H. Gilkey, division engineer, Central of Georgia; L. G. Byrd, bridge and building supervisor, Missouri Pacific; W. E. Tillett, assistant section foreman, Chesapeake & Ohio; Robert White, section foreman, Grand Trunk Western; W. P. Nichols, supervisor of track, Chesapeake & Ohio; and W. Rambo, roadmaster, Missouri Pacific. Substantially all of these contributors agree that it is better to have the inspection made by the foreman and supervisor, rather than by a "neutral" tie inspector who knows little about local conditions, and who sometimes is unwilling to give the individual ties the close scrutiny they should have.—Editor.]

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Footings For Crib Walls

Under what condtions, if any, and to what extent is it desirable to provide concrete footings for concrete crib walls ?

Footings Are Seldom Required

By Assistant Engineer of Bridges

Where a concrete crib wall is erected on soil of ordinary bearing capacity, there is no need to provide for special foundations. All that is required is to excavate to a sufficient depth to insure that the bottom of the wall is well below the frost line. Relief from excessive toe pressures is obtained in part by placing sufficient batter on the face of walls of moderate height. For higher walls, this relief can also be obtained in part by doubling the width of the lower tiers by constructing an additional line of cells at the rear and building them up to the proper height.

If the ground is soft or the toe pressure is abnormal, it may be desirable to insure the stability of the wall by the construction of a temporary footing if the wall itself is temporary in character, or a permanent footing of concrete if the wall is to be permanent. One of the important advantages of crib walls is the fact that they are able to withstand considerable vertical and lateral distortion without losing their stability. Walls that are in prominent locations may become unsightly if there is much of this distortion, so that it may be desirable to provide permanent footings in some cases purely for the purpose of maintaining a good appearance.

Does Not Use Concrete Footings

By M. HIRSCHTHAL

Concrete Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

In none of the numerous installations of concrete crib walls on our line, totaling many thousand feet of wall, have we found it necessary to provide concrete footings. These walls are serving under a wide range of conditions, including a considerable length of wall across the Hackensack Meadows, a salt marsh, where the soil is a peat formation and so soft that it has a very low bearing value.

About the only place where I can conceive of the need for a concrete footing is where the soil is quite compressible and the toe pressure is abnormally high for this type of construction. In cases of this kind we have preferred to construct the usual form of retaining walls, on either spread footings or piles, rather than to risk the stability of the crib wall.

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Storing Screens and Awnings

When removing awnings and door and window screens from offices, stations and other buildings and storing them for winter, what provisions should be made to insure that they will be in condition for use the following season? By whom should this be done and where should they be stored ?

Should Be Done by Carpenter Forces

By A. T. HAWK

Engineer of Buildings, Chicago, Rock Island & Pacific, Chicago

Awnings and screens should be removed as soon as weather conditions make their continued use no longer necessary. They should be taken to a storeroom or workshop for general overhauling and storage during the winter months. Usually there is a dry basement or a storeroom in office buildings where a small amount of carpentry repair work can be done. If so, this is the best place to take the awnings and screens. Here awnings can be patched or the canvas can be renewed, and any work necessary to the iron frames, such as straightening, can be done. Here also the screens can be repaired, painted or otherwise put into serviceable condition. After repairs are completed, they should be stored in overhead or other suitable racks where they will be safe from damage and ready for replacing as soon as spring is suitably advanced.

Out on the line, the bridge and building forces usually have a small shop at some central point, which is suitable for doing small odds and ends of work. Screens and awnings from outlying buildings can be sent to this shop and repaired during the winter as time is available, in this way at practically no cost except for the necessary material.

Awnings and screens that are allowed to remain on buildings over winter deteriorate rapidly and are certain

to be in a worse state of repair than at the beginning of this season. Where this is permitted, necessary repairs are often neglected in the rush of starting the season's work, and if attended to, the cost is greatly in excess of that by the method suggested.

Is Done by Janitor or Agent

By G. A. RODMAN
General Supervisor of Buildings, New York, New Haven & Hartford, New Haven, Conn.

It is our custom to provide these facilities only at general offices, restaurants, sleeping quarters and a few stations and signal towers which are so situated as to require them. In general, the screens and awnings are removed by the person in charge of the building, that is, the janitor or agent. If no competent man is in charge, the work is done by the bridge and building forces. They are stored in any clean dry space that is available, such as attics, storerooms or cellars, and when repairs are necessary, the maintenance of way carpenters do the work, except on the awnings which are turned over to some regular awning maker.

Cutting Edge For Adzes

What is the most satisfactory width of cutting edge for hand adzes ?

A Width of 4¼ In. Is Most Satisfactory

By L. G. BYRD
Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

Hand, or foot, adzes are not in as great demand today as they were in previous years, owing to the large number of ties and the great amount of bridge timber that are adzed and framed by machines before treatment. Because of the very much more limited use which is now required of this tool it is desirable that it be so proportioned that it can be used for both light and heavy work. When working light material, an adze that is too heavy, or that has too wide a cutting edge, is likely to damage the timber.

It is my experience that an adze suitable for both classes of work should be of the type known as a shipcarpenter's adze, with a spur head. The cutting edge should be 4¼ in. wide; the overall length of the tool should be about 11 in.; and it should weigh about 3¾ lb. An adze of this type and size can be used for both light and heavy work with about the same facility. From a safety point of view, it will eliminate some of the hazard to workmen which exists when they attempt to use a tool that is too heavy or has too wide a cutting edge.

Width of Edge Not Only Important Feature

By C. W. BREED
Engineer of Standards, Chicago, Burlington & Quincy, Chicago

Within the range of my experience the discussion of the most satisfactory width of cutting edge for hand adzes goes back to a heavy clumsy implement, having an elliptical eye to permit the use of the same handles that were used in picks and mattocks. It was made of carbon steel and had a cutting edge from 5½ to 6 in. wide. This device was scarcely worthy of the name of tool, which implies an implement for skillful, efficient workmen, since the width of the cutting edge and the variety of steel made it so difficult to keep it sharp that its performance savored of hacking rather than cutting. Furthermore, the position of the cutting edge was so nearly at right angles with the handle that the workman was required to lean far forward in a tiring position, particularly when the blade was ground near to the limit of wear. This could have been offset to some extent if the blade had been narrower and sharp so that the work could have been done more quickly. It was difficult to grind an even surface on so wide an edge. Later the carpenter's adze was supplied to track men, and although this was some improvement, the wide cutting edge was retained and most of the disadvantages of the former type were still present.

Two things happened to effect a change in the design. High rails came into general use, requiring a longer blade to enable the user to work efficiently over the rail, and the introduction of alloy steels brought about improvement in the quality of the edge of cutting tools.

Increasing the length of the tool meant an increase in the weight if the same width of cutting edge was to be retained. Manifestly, such a tool would have been too heavy for effective use, while the price of the alloy steel would have made it too expensive. For these reasons, the cutting edge was reduced from five plus inches to four inches and the angle between the blade, or cutting edge, and the handle was reduced. The result of these changes is an adze with an edge that can easily be kept in surface and sharp, and that can be used comfortably over the highest rail. Apparently this is the most desirable width of edge for an adze.

Mile Numbers on Poles

Where mile numbering is placed on telegraph or other pole lines, what is the most practicable and economical method of placing the numbers on creosoted poles ?

Finds Aluminum Paint Best

By J. J. LA BAT
Assistant Bridge and Building Foreman, Missouri Pacific, Wynne, Ark.

There is a wide variation in the methods employed on different railways for indicating mile numbering. Some follow the practice of setting mile posts. Some fasten boards to telegraph or other poles, on which the mile numbers are stenciled. Others use metal numerals, especially on creosoted poles. The boards may offer a serious obstacle to linemen when climbing a pole to which they are attached, while the metal numbers are also inconvenient at times, and both have been known to cause accidents.

If the numerals are made of none-corroding metal, they require little or no maintenance. The boards, however, must be restencilled at relatively frequent intervals. Since they are awkward to reach, the cost of doing this work is usually out of proportion to other similar painting work, the time required being excessive.

On the Missouri Pacific we have been testing the possibility of using aluminum paint on creosoted poles to indicate the mile numbering. This test has been running for about three years and the results to date have been very satisfactory. First an aluminum primer is applied, after which two coats of aluminum finish are used as a background. A variation which has been tried is to omit the primer and apply three coats of the finishing paint. Both seem to give equally satisfactory re-

sults. After the aluminum paint has dried, the numbers are stencilled on with signal-black paint. The numerals stand out sharp and clear against the silver background, and are as distinct after 32 months as when first applied. No discoloration from the creosote has shown through the aluminum paint.

In addition to the advantage of reducing the hazard to linemen, the original cost of making the application is about 30 per cent below that of manufacturng the boards, stenciling and applying them. It is substantially the same amount below the cost of the metal numerals applied. Furthermore, the cost of maintenance is materially reduced, since repainting is needed only at infrequent intervals.

This Road Uses Mile Posts

By H. R. DUNCAN
Superintendent of Timber Preservation, Chicago, Burlington & Quincy, Galesburg, Ill.

On the Burlington we do not place numbers on pole lines, either to identify the poles or mark the miles. On all of our lines we use the usual type of mile posts and identify our poles by referring to the nearest mile post plus or minus so many poles. I have observed, however, that some roads place mile numbering on pole lines and that the poles in many telegraph, telephone and power lines are numbered. As a result of my observations I have come to the conclusion that the best method of numbering pole lines for the purpose mentioned is to apply pressed or cast numerals about two inches high.

Aluminum Figures Give Best Results

By K. H. HANGER
Engineer Maintenance of Way, Missouri-Kansas-Texas, Dallas, Tex.

Figures of the proper size to be distinct, curved to fit the circumference of an average pole, die stamped from, say, 22-gage aluminum sheets, and attached to the pole with 6-penny galvanized wire nails provide, I believe, the most satisfactory means of placing mile numbering on creosoted poles. Over a period of time they should also be the most economical. This practice is similar to that of many power and utility companies who use smaller stamped aluminum figures for numbering their poles.

It is extremely difficult to maintain numbering on creosoted poles with ordinary paint, particularly those that have been recently treated. This difficulty is accentuated in a hot climate. Since the metal numerals require no painting, they provide a very satisfactory means of numbering miles or poles where these conditions exist.

Favors Using Bright Metal Numerals

By W. A. SUMMERHAYS
Manager, Forest Products Inspection and Research Bureau, Illinois Central, Memphis, Tenn.

I would like to offer as my first observation in this discussion, that owing to changing conditions, the need for mile numbering is constantly growing less. Maintenance employees today cover their assigned territory easily and quickly with motor cars. There is less reference now than formerly to mile numbering in reports and correspondence when giving details of the location of broken rails, low joints, etc. Today there is no necessity for having sign boards every 5 or 10 poles, that can be seen from passing trains. Neither does there seem to be any need for placing two numbers at a mile post to indicate the distance from both ends of the line.

When paint is applied to creosoted poles, it soon becomes discolored and thus requires frequent renewal. For this reason, I believe that the best method is to apply bright metal numerals to the side of the poles nearest the track to give the distance from the principal terminal or the one to which the mile numbering is most often referred. It would seem that one set of numbers placed on the pole nearest to the end of the mile is all that is needed under modern operating conditions.

Line, Surface or Gage?

What is the relative importance of line, surface and gage in maintaining smooth-riding tracks? Why ?

Difficult to Make Distinction

By F. M. THOMSON
District Engineer, Missouri-Kansas-Texas, Parsons, Kan.

It is no easy matter to make a definite destinction between the relative importance of these three elements of maintenance. Not only is it highly necessary to strive for perfection in each if smooth-riding track is to result, but they are so closely inter-related that any irregularities that are permitted to continue for an appreciable time in one of them will result in the eventual development of corresponding irregularities in the other two. It is well established that track that remains out of surface will develop poor line and irregular gage, while good line is impossible without correct gage.

It is true that a temporary recovery of smooth riding may often be obtained by lining track that is only slightly out of surface. This is not a permanent remedy, however, since neglect to eliminate the irregularities in surface, even though they be slight, will soon result in defects in line and gage. Track must be kept in excellent cross level as well as in true gage to insure those qualities of surface and line which are essential to smooth riding at high speed.

All Are Closely Inter-Related

By E. H. PIPER
Engineer Maintenance of Way, Chicago, Burlington & Quincy, Lincoln, Neb.

In the maintenance of smooth-riding track, these three factors are closely inter-related. Without question surface is the most important, line coming next, while gage is nearly as essential. I put surface first because the labor required to maintain good surface is far greater than is required for the other two. If the gage is wide or irregular, however, the track is, sooner or later, "whipped" out of line and surface.

Unceasing work is required to maintain good surface, particularly where the roadbed is not stable. Surfacing and the lighter work of smoothing are done at all seasons, except when the ballast is frozen, and are usually continued as long as practicable to insure first-class winter-riding conditions. The extent to which imperfect surface is tolerated depends on the standard of maintenance and the speed and character of the traffic, safe operaton being paramount.

Wear and tear on rollng stock increases rapidly as the surface degrades. In fact, passenger and fast-freight schedules are determined entirely on riding conditions. Rough track is especially dangerous on curves.

For smooth riding the cross level must be correct. What appears to be a fair surface may sometimes be afflicted with a non-uniform cross level, so that the opposite sides of the track are alternately high and low. This causes the cars and locomotives to sway from side to side, always bringing undue pressure and lateral thrusts on the low rail. This rail tends to settle more rapidly, while at the same time it shifts out of line. Short low spots in alternate rails are dangerous as they cause violent rocking of the cars and locomotives with the possibilities of derailment, particularly at high speeds.

Track that is out of surface soon gets out of line as a result of the lateral thrust of the wheel flanges. Low spots on curves tend to get out of line more quickly than on tangent. Correct gage is essential to the maintenance of smooth-riding track, since, although the track may be in good surface, irregular gage invariably results in irregular line, and increased maintenance costs as well. To insure smooth-riding track, constant use must be made of the level board, gage and lining bars.

All Three Are Essential

By W. RAMBO
Roadmaster, Missouri Pacific, St. Louis, Mo.

All three of these factors are essential to smooth-riding track, surface being the most important, with line and gage contending for second place. These latter two are so closely related that it is next to impossible either to secure or maintain good line without uniform gage.

It is possible to have well surfaced track that does not ride smoothly because of irregular line or gage. It is extremely difficult to maintain good surface under these conditions, however, owing to the strains that are developed by the lurching of the cars and locomotives and the lateral thrust of the wheels as a result of line swings or the lateral play that is permitted by wide or irregular gage. Likewise, gage cannot be maintained easily on track that is out of line or surface. By reason of these facts, all three factors, line, surface and gage, must be as nearly perfect as practicable to insure the highest degree of smoothness in the riding qualities of the track.

Line Is Most Important on Curves

By E. E. EDWARDS
Southern Pacific, Fields, Ore.

Smooth-riding track depends on the degree of perfection attained in all of these three important elements of maintenance. Surface is probably of most importance on tangents, but line assumes the position of greater importance on curves. Yet in neither case can either of the other two factors be neglected with impunity.

Since no curve has the correct superelevation for the higher speeds, because superelevation is always a matter of compromise between requirements of varying speeds, line becomes of first importance. When the speed is above the median line, wheel flanges press closely against the outer rail and the cars which they support are, therefore, extremely sensitive to any variation in the line of this rail. Such variations change the rate of curvature and, therefore, the magnitude of the centrifugal force operating against the moving equipment. Rapid changes of any magnitude in this force cause violent lurching of the cars, which is translated into discomfort to passengers or damage to lading. In extreme cases it may cause derailments. In any event, poor line on a curve is followed quickly by wide and irregular gage and deterioration in surface.

On the other hand, perfect alinement is quickly spoiled by defects in surface or gage on both tangents and curves. The inter-relation of line and gage seems to be more marked, however, than that of either of the two with surface, although both are close related with that factor. So closely are all three interconnected as essentials of smooth-riding track that I consider it a waste of time to correct the defects in one without giving similar attention to the others.

[Additional answers were received from Henry Becker, section foreman, St. Louis-San Francisco; W. H. Sparks, general track inspector, Chesapeake & Ohio; W. E. Tillett, assistant section foreman, Chesapeake & Ohio; and W. P. Nichols, supervisor of track, Chesapeake & Ohio. Mr. Becker called particular attention to the damage rail on curves receives when the gage is wide or irregular and to the difficulty experienced in lining track that has irregular gage. Mr. Tillett stressed the danger of derailment where the gage is too wide or changes abruptly and the added resistance to trains if it is too narrow. Mr. Sparks gave considerable weight to the part which correct gage plays in conserving the life of rail on tangents as well as curves, while Mr. Nichols believes that line, surface and gage are equally important.—Editor].

Renewing High Trestles

A further answer to the following question which was discussed in the October issue:

When renewing a high trestle and filling the ends to shorten it, should the piling be driven before or after the filling is completed? Why ?

Depends on Height and Other Conditions

By D. RINTOUL
General Inspector of Bridges, Southern Pacific, San Francisco, Cal.

In general, the difficulty experienced in maintaining bents in new fills is that they are pulled down by the settlement of the filling material and often are forced out of position. Where the new fill ranges from 12 to 20 ft. high, if practicable to do so, the permanent bents at the ends of a trestle should not be driven until the added material has come to rest, or at least until settlement is nearly completed. Too often this is not convenient, however, because of the prolonged speed restrictions that are necessary and the frequent need of restoring the track to proper surface and line.

In cases where the existing bents are weak, we strengthen those around which the fill is to be made and allow them to support the track through one wet season. This insures that the major part of the settlement will occur. We then drive the permanent bents, endeavoring to obtain sufficient penetration in the original ground or older fill to insure that the piles will not settle. If the new fill is less than 12 ft. and the formation makes it practicable to obtain satisfactory penetration, we follow the practice of driving the piles and completing the bents before the fill is made.

To give some idea of the settlement that actually takes place in bents the trestle across Great Salt Lake was completed in 1902, the piles being driven to refusal. The fills were then completed, the material extended out and around the first eight bents at each end of the trestle. These bents were gradually pulled down by the settlement of the fills and now stand from a few inches to as much as five feet below their original elevation.

New and Improved Devices

New Lufkin Steel Tape

A NEW steel drag tape, known as the Hi-way drag tape, which is specially designed for railroad and other heavy work, has recently been placed on the market by the Lufkin Rule Company, Saginaw, Mich. This tape is 5/16 in. wide and is made of extra-weight special steel that is especially resistant to breakage. The etched

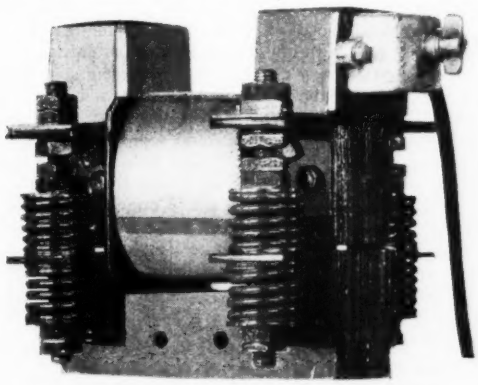
Illustrating the Manner of Marking the Hi-Way Tape

graduations, which have a Nubian finish, are cut deeply into bright high portions of the tape itself, no sleeves or babbitt being used.

The tape is graduated in feet, with the end feet marked in tenths and with a mark 2 ft. 4¼ in. from zero to indicate one-half standard railroad gage. It may also be obtained with an extra foot before zero marked in tenths. The tape is provided with heavy brass end clips and a pair of rawhide thongs. It may be supplied in lengths ranging from 100 ft. to 300 ft. and is furnished either with or without a metal reel.

New Syntron Concrete Vibrator

A NEW line of equipment for vibrating concrete in forms, for vibrating material in hoppers in order to keep it flowing freely, and for other applications where the vibration of bulk material proves advantageous, has been placed on the market by the Syntron Company, Pittsburgh, Pa. In addition to their use for

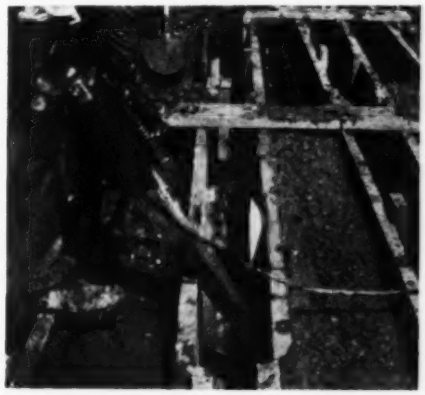


A Close-Up View of One of the New Vibrators

vibrating concrete in building construction, these units are also employed in the manufacture of concrete products such as cribbing, reinforced concrete piling, etc.

The new vibrators are simple in construction, consisting of a horseshoe magnet and an armature, with the gap between them held open by means of springs. By utilizing the Syntron principle of a pulsating current, this gap is closed 3,600 times per minute, using 60-cycle alternating current. Moving at such a high speed, the armature sets up a vibration that can be applied in a direct line toward any mass that it is desired to agitate.

The vibrators, which are built in various sizes for different operations, are adapted to various kinds of work by a number of special attachments. One of these consists of a handle and a vibrating spud for vibrating floor beams, flat-slab placements or reinforcing bars in



Fitted With a Handle and a Vibrating Spud, This Unit Is Being Used to Vibrate the Concrete in Floor Beams

concrete products. Another attachment consists of a vise clamp for fastening the vibrator to the studs or wales of building forms, while a third is a chain clamp for attaching the vibrator to a round column or a round sewer pipe mold. Model V-120, which is the largest of the line of vibrators, can be fitted with a puddling board for use in the mass placement of concrete.

A. R. E. A. Proceedings

PROCEEDINGS of the American Railway Engineering Association for 1932. 827 pages, 6 in. by 9 in., illustrated. Bound in cloth, and leather. Published by the Association, 59 East Van Buren Street, Chicago. Price, cloth, $8; half morocco, $9.

This volume comprises the report of the thirty-third convention of the American Railway Engineering Association, held in Chicago on March 15 and 16. The book follows the form and arrangement of preceding editions and contains about the same number of pages as last year's volume, but owing to the use of a larger amount of composition per page, the total amount of material presented is greater. The volume contains the reports of 28 standing and special committees, together with the discussion that followed their presentation at the convention. Much of the subject matter embraces a continuation of studies pursued through several years. However, the following are worthy of special mention by reason of their importance or distinctive character. Thus, the subject matter includes a discussion of Spray Painting; Crossing Plank and Their Substitutes; Protecting the Roadway from Washouts; Specifications for Ballast and the Cost of Maintaining Track with Different Forms of Ballast; and An Analysis of the Practices Followed by Certain Roads that have Effected Appreciable Reductions in the Cost of Maintenance of Way.

CORRECTION—In his article on page 616 of the October issue, James I. Purich stated that as many 33-ft. 100-lb. rails could be laid in 5 min., if turning was not necessary, as required 20 min. if they had to be turned. Through a typographical error, the number of rails, 10, was omitted.

News of the Month . . .

Railroad Credit Corporation Loans

The Railroad Credit Corporaton on October 1, had either actually made or authorized loans to railroads to meet their fixed interest obligations totaling $31,681,529, according to the monthly report of the corporation filed with the Interstate Commerce Commission. This organization is administering the funds derived from the rate increases authorized by the I. C. C. early this year. Collection of the rate increases totaled $35,764,606 in the first seven months, the increases having become effective on January 4.

Southern Pacific of Mexico Returned to Owners

The Southern Pacific of Mexico, which since July 20 had been operated under the supervision of the Ministry of Communications of the Mexican government, was returned to the owners on September 26. The property was idle from June 27, when the employees walked out after the company decided to reduce wages 10 per cent, until operation was resumed under government direction. A committee has been named by the railroad and the labor unions to settle the disputed wage and personnel reduction controversy by conference.

Eight Months Net is 0.93 Per Cent

For the first eight months of this year the Class I railroads of the United States had a net railway operating income of $152,294,615, which was at the annual rate of return of 0.93 per cent on their property investment, as compared with a net operating income of $353,908,889, or 2.15 per cent, in the same period of 1931, according to reports compiled by the Bureau of Railway Economics. Operating revenues for the first eight months totaled $2,091,356,725, as against $2,928,960,214 for the same period in 1931, a decrease of 28.6 per cent. Operating expenses amounted to $1,661,990,574, as compared with $2,266,164,675, last year, a decrease of 26.7 per cent. Taxes decreased from $219,327,549 in 1931 to $197,967,471 this year, or 9.7 per cent.

Estimate Better Carloadings

Freight car loadings in the last quarter of this year will be only 10.4 per cent less than the actual loadings in the same quarter of 1931, according to estimates compiled by the thirteen shippers' advisory boards. The same boards estimated that the carloadings in the third quarter of this year would be 21.1 per cent under the actual loadings for the third quarter of 1931, thus indicating that a substantial improvement in the fourth quarter is expected. Of the 29 principal commodities, it is anticipated that only cotton will show an increase, which is expected to be about 15.4 per cent. The percentages of decrease estimated for the other 28 commodities range from 0.8 per cent for sugar, syrup and molasses, to 50.8 per cent for ore and cottonseed.

Floods in California Mountains

It is estimated that $300,000 will be required to repair the damage done to the Southern Pacific's line between Tehachapi, Cal., and Bena, on September 30, when a cloudburst on the north slope of the Tehachapi mountains washed out several hundred feet of track and destroyed nine bridges. A Southern Pacific engineman and brakeman were not accounted for and unofficial reports stated that 40 trespassers riding freight trains were carried into the stream. This line is used jointly by the Southern Pacific and the Atchison, Topeka & Santa Fe. One Santa Fe locomotive which had been carried away by the force of the water had not been found on October 6.

Railway Purchases in First Six Months

Class I railways of the United States expended $223,700,000 in the markets of the country for materials and supplies during the first six months of 1932, exclusive of locomotives and cars and materials acquired in lump-sum contracts, as compared with $386,050,000 in the corresponding period of 1931, according to figures compiled by the Railway Age from reports received from the railroads. This sum includes $84,750,000 for locomotive fuel and $138,350,000 for miscellaneous supplies, consisting of $14,850,000 for ties, $11,550,000 for rails and $112,550,000 for repair parts for locomotives and cars, track materials, etc. Expenditures made for ties by all the railroads in June were greater than for any month this year.

Coolidge Committee Organizes

The committee which has been chosen by savings banks, insurance companies and other organizations interested in the welfare of the railroads to make a thorough study of the railway situation and of which former President Calvin Coolidge has been appointed chairman held its first meeting in New York on October 7, and has commenced its investigation. Other members of the committee are Bernard M. Baruch, vice-chairman, Alfred E. Smith, Alexander Legge and Clark Howell. Dr. Harold G. Moulton, president of the Brookings Institute of Washington, D. C., has been retained as chief investigator for the committee. It is expected that the report of the committee will be completed in three months.

New Freight Cars and Locomotives

In the first eight months of 1932 the Class I railroads of the United States placed in service 2,477 new freight cars, as compared with 9,655 in the corresponding period of last year, according to the Car Service division of the American Railway Association. New locomotives placed in service in the first eight months totaled 35 as compared with 103 in the same period last year. On September 1 of this year the Class I railroads had 1,423 new freight cars on order as against 6,643 on the same date last year, while new locomotives on order on September 1 numbered 5 as compared with 29 last year.

Price of Rails Reduced

For the purpose of stimulating the purchase of rails, the leading rail producing companies of the United States have announced a reduction in the price of standard rails from $43 to $40 a ton, approximately 7 per cent. This move, which was announced first by the United States Steel Corporation on October 20, followed a meeting in the office of Myron C. Taylor, chairman of that company, which was attended by executives representing eight important railway systems. This is the first reduction that has been made in the price of rails in recent years, the price having held at $43 a ton since 1923, when it was increased from $40.

Lawyers Favor Truck Regulation

A committee of the section of public utility law of the American Bar Association, at its annual meeting in Washington on October 10, submitted a report saying that "the unfairness as between the regulation of railroads and the lack of regulation of interstate commerce by motor buses and motor trucks should be eliminated." The report of the standing Committee on Commerce also expressed the opinion that Congress should pass an act regulating the transportation of both passengers and freight by motor vehicles and giving the Interstate Commerce Commission jurisdiction over the fixing of rates, fares, charges, through routes and divisions.

Employees Plan National Group

About 75 delegates, representing the same number of ship-by-rail clubs and railway employees' and taxpayers' associations in 21 states, met in Chicago on September 30 to take preliminary steps toward extending their organizations to other states and toward the formation of a national body to serve as a point of contact for the various state associations and to co-ordinate their activities. It was decided that the formation of a permanent national organization at this time would be premature, and that for the

present the organization will restrict its activities entirely to keeping its constituent organizations in contact with each other and to encouraging the formation of associations in other states.

Railroads Recall Employees

Because of the increase in railway business that has taken place during recent weeks a number of railroads have been required to hire additional employees. On October 1, the New York Central inaugurated a tentative program of increased operation in its car and locomotive shops involving the employment of about 4,000 men. The Cleveland, Cincinnati, Chicago & St. Louis has put to work 1,600 shopmen at its Beech Grove shops, while the Central of New Jersey has recalled 233 employees for service in its repair shops. The Missouri Pacific has re-employed 100 men in its car shops at various points and has added 60 employees to the station forces in the cotton territory in Arkansas.

R. F. C. Loans for Two Railroad Projects

During the last month immediate construction of two large railroad projects has been made possible through the financial aid of the Reconstruction Finance Corporation. The corporation has agreed to bid for bonds of the state of Louisiana and to purchase bonds of the Public Belt Railroad Commission of the city of New Orleans, La., in amounts sufficient to provide for the construction of a combined railroad and highway bridge across the Mississippi river near New Orleans, at a cost of about $13,000,000. The R. F. C. has also agreed to loan $3,850,000 to the Denver & Rio Grande Western for the construction of the Dotsero cutoff, a 40-mile line extending between Orestod, Colo., on the Denver & Salt Lake (Moffat line) and Dotsero on the D. & R. G. W.

Royal Commission Submits Report

The Canadian Royal Commission on Transport, which was appointed to make a comprehensive investigation of the transportation situation throughout Canada, has submitted its report to the Dominion government at Ottawa, Ont., after about a year of study. Among other things the report recommended the preservation of the identities of the Canadian National and the Canadian Pacific, the release of the management of the C. N. R. from political influence and community pressure, a more rigorous check by the government upon proposed capital outlays for that road, and an elaborate plan for closer co-operation between the C. P. R. and the C. N. R. in order to eliminate costly competition between them. The commission was composed of Justice Lyman P. Duff of the Supreme court of Canada, Dr. Clarence Webster, Sir Joseph Flavelle, L. F. Loree, president of the Delaware & Hudson, Lord Ashfield of Southwell, Beaudry Leman and W. C. Murray.

Association News

International Railway Maintenance Club

The next meeting of the International Railway Maintenance Club will be held at the Hotel Statler, Buffalo, N. Y., on Thursday, November 10. Following luncheon, which will be served at 12:30 p. m., the meeting will consider an illustrated paper entitled, All Types of Rail Joints, to be presented by W. E. Gadd of the Rail Joint Company, New York. The annual election of officers will also take place at the meeting.

The Railway Tie Association

The next or sixteenth annual convention will be held at Richmond, Va., on May 10-11, 1933, according to a decision reached tentatively by the Executive committee at a recent meeting. The Jefferson Hotel has been selected as convention headquarters. This departure from the past practice of holding the meetings in the Central West has been decided upon as a means of interesting eastern tie producers in the association by making this meeting more accessible to them.

The Wood Preservers' Association

Members of the Executive committee met in Chicago on October 19. After transacting routine business, they devoted the major portion of the day to the development of the program for the annual convention which will be held at the Hotel Sherman, Chicago, on January 24-26, 1933. Advice from the chairmen of the various committees indicate that the reports are well in hand and that they will maintain the previous high standard of the association. As heretofore, the session on Wednesday forenoon will be devoted to a "user's day" program, with addresses by prominent engineers who have had extensive experience with the use of treated timber.

American Railway Engineering Association

Fourteen committees and many subcommittees held meetings during October, most of them for the purpose of giving final consideration to the work of the current year and of approving reports for presentation at the convention next March. The committees which held meetings during the month were those on Wooden Bridges and Trestles, at Chicago on October 7; Yards and Terminals, at Detroit, Mich., on October 10; Iron and Steel Structures, at Buffalo, N. Y., on October 13 and 14; Uniform General Contract Forms, at New York on October 17; Wood Preservation, at Chicago on October 18; Water Service and Sanitation, at Chicago on October 18; Records and Accounts, at Pittsburgh, Pa., on October 20; Rail, at Chicago on October 20; Ballast, at Pittsburgh, Pa., on October 21; Rules and Organization, at Chicago on October 21; Roadway, at Chicago on October 24 and 25; Ties, at Chicago on October 25 and 26; Shops and Locomotive Terminals, at Cleveland, Ohio, on October 26; and Maintenance of Way Work Equipment, at Chicago on October 28.

Bridge and Building Association

A meeting of the Executive committee was held at Chicago on Saturday, October 1, with President C. S. Heritage, Vice-Presidents T. H. Strate and E. C. Neville, A. B. Scowden, director, C. A. Lichty, secretary, and Past Presidents J. S. Huntoon, F. E. Weise and Elmer T. Howson present. After considering the financial status of the association, it was decided to fix the annual dues for the current year at $2, the same as last year. In the absence of a convention, it was decided to continue standing committees, four of whose reports were published serially in *Railway Engineering and Maintenance* early this year. It was decided to create a new committee to study and report on lessons, problems and practices brought about by the depression.

Maintenance of Way Club of Chicago

Joe Marshall, special representative of the Freight Claim division, American Railway Association, was the speaker at the meeting of the Maintenance of Way Club on Wednesday evening, October 19, with an attendance of 40. The subject of the meeting was "Loss and Damage and the Maintenance Man" and dealt with the efforts which the railroads have made to reduce losses resulting from improper handling of freight, with particular reference to the part that the maintenance of way forces can have in their reduction.

The next meeting will be held on Wednesday evening, November 16, when J. A. Peabody, engineer maintenance of way, Chicago & North Western, will talk on The Conservation of Rail Joints.

Metropolitan Track Supervisors' Club

The first fall meeting of the Metropolitan Track Supervisors' Club was held on Thursday, October 20, at the usual place of meeting in New York City. Following dinner at 6 p. m., the club was addressed by A. A. Johnson, engineer of track, Delaware, Lackawanna & Western, who discussed the relative advantages and disadvantages of train service electrification from the standpoint of the maintenance of way department, speaking in the absence of George J. Ray, chief engineer of the Lackawanna, who was to have discussed this subject but who was unable to be present. Following Mr. Johnson, J. S. Thorp, electrical engineer of the Lackawanna, gave an illustrated talk on the high lights of the electrification project of the Lackawanna in the New York suburban zone.

Personal Mention

General

Philemon S. Lewis, superintendent of the New York division of the Reading, and formerly connected with the engineering and maintenance of way departments of this road, has been appointed assistant to the vice-president in charge of operation and maintenance. Mr. Lewis was born on May 10, 1889, at Springfield, Ill., and attended Princeton University, from which he was graduated in 1911. In July of that year he entered railway service with the Philadelphia & Reading (now the Reading), and has been in the continuous service of this company to the present time, except for the period of the World War. During 1911 he held the positions of rodman at Williamsport, Pa., and construction inspector at St. Clair, Pa. From August 12, 1912, to September 16, 1914, he served as assistant supervisor at Harrisburg and Pottstown, Pa., and on the latter date he was appointed interlocking inspector at Philadelphia, Pa. From 1915 to 1917 he served as supervisor at Camden, N. J., and Olney, Pa., and as trainmaster at Reading, Pa. On September 12, 1917, he entered

Philemon S. Lewis

the U. S. Army and was commissioned first lieutenant of engineers. A year later he was commissioned captain of engineers, and in February, 1919, major. While in France Mr. Lewis held the positions of executive officer to chief engineer, First Army; executive officer, deputy director-general of transportation, and chief of troop movement bureau, Paris. After he was discharged from the army he again returned to the Reading as trainmaster at Philadelphia. In April, 1920, he was appointed assistant superintendent of the Atlantic City railroad, a subsidiary of the Reading, and on August 1, 1921, he was promoted to superintendent of that line. Mr. Lewis was appointed superintendent of the New York division of the Reading on February 1, 1930.

Harvey B. Titcomb, president of the Southern Pacific of Mexico, with headquarters at Guadalajara, Jal., Mexico, whose railway experience embraces considerable service in the engineering and maintenance of way departments of the Southern Pacific, has resigned, effective November 1. Mr. Titcomb was born on December 10, 1871, at Indianapolis, Ind., and received his higher education at Cogswell Polytechnical College, San Francisco, Cal. He entered railway service in 1889 as a relief agent and telegraph operator on the Southern Pacific at Reeley, Cal., and served with this company and various subsidiaries continuously until his recent resignation. In 1891 Mr. Titcomb entered the maintenance of way department as a draftsman in the general office and from 1898 to 1900 he served as assistant engineer and roadmaster on the Western division, then being transferred to the Sacramento di-

Harvey B. Titcomb

vision. Five years later he was promoted to division engineer of the San Joaquin division and a year later he was transferred to the Los Angeles division. In 1909 Mr. Titcomb was advanced to district engineer, serving in this position at Los Angeles, Cal., and San Francisco until 1917, when he was transferred to the operating department as superintendent of the Stockton division. In 1918 he was made vice-president and general manager of the Pacific Electric railway, a subsidiary of the Southern Pacific, with headquarters at Los Angeles, which position he held until 1921, when he was elected president of the Southern Pacific of Mexico, holding this position continuously until his resignation. Mr. Titcomb also served at various times as president of the Arizona Eastern, the East Coast Oil Company, the Southern Pacific Navigation Company and the Sunset Development Company, all subsidiaries of the Southern Pacific.

Camilo E. Pani, chief of the personnel department of the National Railways of Mexico, and formerly chief engineer of these lines, has been appointed assistant executive president, with headquarters as before at Mexico, D. F. Mr. Pani, who will continue in the capacity of chief of the personnel department, was born on November 2, 1868, at Aguascalientes, Aguas., and was educated in various schools in Mexico, finishing his studies at the Sheffield Scientific School of Yale University in 1887. He entered the service of the National of Mexico on January 1, 1889, as a draftsman in the engineer's office at Aguascalientes, being promoted to chief draftsman in the engineer's office at San Luis Potosí, S. L. P., in June of the same year. From March, 1890, to June, 1910, he was engaged in various

Camilo E. Pani

phases of railway location, construction and maintenance, serving as topographer and transitman on location and other preliminary work, as assistant resident engineer and resident engineer on port work at Tampico, Tamp., and on the construction of various lines, and in various capacities in the maintenance of way department. At the end of this period he was promoted to supervising engineer of the system, which position he held until April, 1914, when he was further advanced to general manager, with headquarters at Guadalajara, Jal. In August, 1920, Mr. Pani returned to the engineering department as assistant chief engineer, with headquarters at Mexico, D. F., and in October of the following year he was appointed subchief engineer. Four years later he was appointed a member of the personnel commission and on September 1, 1925, he was advanced to chief of the personnel department.

Engineering

G. B. Wall, Jr., assistant division engineer on the Chesapeake & Ohio, with headquarters at Ashland, Ky., has been promoted to division engineer, with headquarters at Clifton Forge, Va., succeeding **C. H. Zentmyer.**

Arthur Ridgway, chief engineer of the Denver & Rio Grande Western, with headquarters at Denver, Colo., has been appointed also chief engineer of the Denver & Salt Lake Western, the line which was incorporated in 1924 by the Denver & Salt Lake (the Moffat Line) for the construction of the Dotsero cut-off, control of which has recently been acquired by the D. & R. G. W. The Dotsero cut-off, contracts for the construction of which have recently been awarded, will

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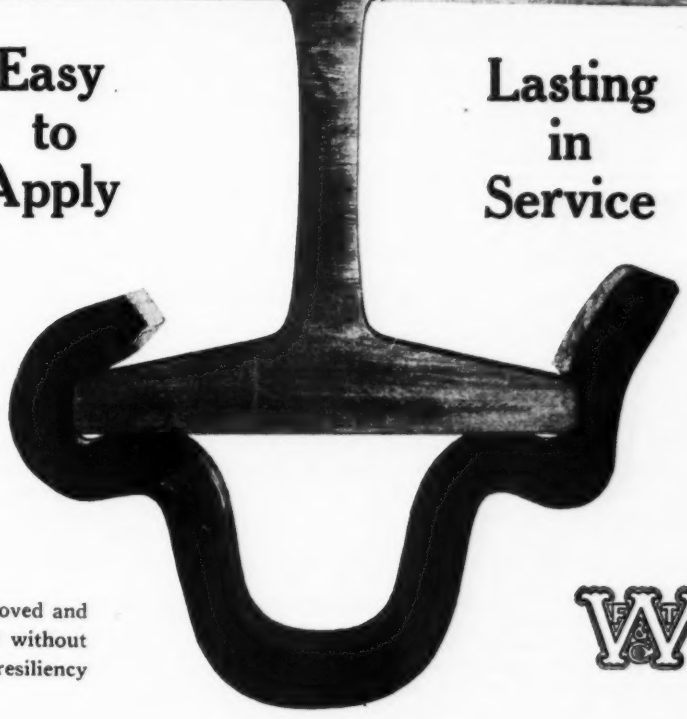

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extend between Orestod, Colo., on the Denver & Salt Lake, and Dotsero on the Denver & Rio Grande Western, a distance of about 40 miles.

Luis Reina has been appointed division engineer of the Centro division of the National Railways of Mexico, with headquarters at Aguascalientes, Ags., succeeding **Carlos Corral,** who has been transferred to the Quéretaro division.

C. W. Engle, assistant division engineer of the Northern-Springfield division of the Cleveland, Cincinnati, Chicago & St. Louis, has been promoted to division engineer of that division, with headquarters as before at Van Wert, Ohio, succeeding **W. D. Williams,** who has retired.

R. A. Gravelle, assistant engineer of the Detroit Terminal of the Grand Trunk Western, has been appointed also to the same position on the Detroit division, with headquarters as before at Detroit, Mich., succeeding **A. L. Ray,** assistant engineer, with headquarters at Durand, Mich., assigned to other duties.

Track

C. B. Brown, assistant track supervisor on the Indianapolis division of the Pennsylvania, with headquarters at Louisville, Ky., has been promoted to track supervisor on the Toledo division with headquarters at Marion, Ohio, to succeed **W. W. Clarke,** who has been transferred to the Indianapolis division, with headquarters at Louisville, to replace **H. Hoge,** deceased. **J. T. Murray,** assistant on the engineer corps, has been promoted to assistant track supervisor on the Columbus division, at Richmond, Ind.

H. D. Brydon Jack, assistant engineer in the construction department of the Canadian Pacific, has been appointed roadmaster on the Brandon division, with headquarters at Virden, Man., succeeding **T. M. Fraser,** who has been transferred to Brandon, Man., on the same division, where he replaces **T. W. Creighton,** who has been transferred to the Kenora division, with headquarters at Winnipeg, Man., where he relieves **P. Sevick.** Mr. Sevick has been transferred to the Portage division with the same headquarters, succeeding **A. Mills,** who has retired. **Frank Topham,** roadmaster on the Revelstoke division, with headquarters at Salmon Arm, has been transferred to the Vancouver division, with headquarters at Mission, B. C., to succeed **P. A. Benson,** transferred. **J. E. Mercer** has been appointed roadmaster on the Kootenay division, with headquarters at Fernie, B. C.

Obituary

H. Hoge, track supervisor on the Indianapolis division of the Pennsylvania, with headquarters at Louisville, Ky., died at Louisville on August 18.

Harry H. Robinson, roadmaster of the Portland Terminal Company, a subsidiary of the Maine Central, died on October 7 after being stricken in his office at Portland, Me.

Supply Trade News

General

The Headley Emulsified Products Company has moved its executive and sales offices from Philadelphia, Pa., to its plant at Marcus Hook, Pa.

The Pettibone-Mulliken Company, Chicago, was placed in receivership by Federal Judge Wilkinson, on October 12, following foreclosure in equity. **C. H. Eib,** president, was appointed receiver.

The Louisville Frog, Switch & Signal Company, Louisville, Ky., has changed its name to the **Louisville Switch & Signal Company,** following the sale of its frog and switch business to the **Morden Frog & Crossing Works,** Chicago. The Louisville Switch & Signal Company will continue to manufacture signal materials, gage rods, bolts, bumping posts and other specialties but will not make frogs, switches, crossings or other track work. While the sale includes the machinery for building the track work, it includes no buildings or real estate. The personnel of the Louisville Switch & Signal Company remains the same as that of its predecessor.

Personal

C. E. Murphy has been appointed district sales manager for the **Morden Frog & Crossing Works,** at Cleveland, Ohio.

Stanley H. Smith has been appointed railroad representative in the Cleveland, Ohio, district for the **American Hoist & Derrick Company,** St. Paul, Minn., with headquarters at Cleveland.

J. E. McFate, formerly a representative of the **Jones & Laughlin Steel Corporation,** has been appointed a sales representative of the **Republic Steel Corporation,** Youngstown, Ohio, with headquarters at Boston, Mass.

William Guy Williams and **Thomas E. Brown, Jr.,** formerly associate engineers of Waddell & Hardesty, have formed a partnership under the name of Williams & Brown, consulting engineers, specializing in the design of fixed and movable bridges, with offices at 150 Broadway, N. Y.

Frank Marmion, assistant to the district manager of sales of the **American Steel & Wire Company,** with headquarters at Birmingham, Ala., has been promoted to district manager of sales with the same headquarters to succeed **J. J. Gilmore,** who has retired because of ill health.

W. M. Vinnedge has been appointed Eastern regional manager of the railroad division of the Worthington Pump & Machinery Corp., with headquarters at Harrison, N. J., to succeed **D. F. Ellis,** who has resigned to re-enter railway service.

Timmons Harmount, manager of the Harmount Tie & Lumber Company, Chillicothe, Ohio, died on October 18. Mr. Harmount had been active in the affairs of the Railway Tie Association, of which organization he was a charter member and past president.

John W. Fristoe, chairman of the board of the T. J. Moss Tie Company, St. Louis, Mo., died in that city on October 15 of pneumonia after an illness of five days. He was born in Salisbury, Mo., on November 13, 1858, and became associated with the T. J. Moss Tie Company at the time of its organization at Higbee, Mo., in 1879. Later he became manager for T. J. Moss at Puxico, Mo., which position

John W. Fristoe

he held until 1893, when the T. J. Moss Tie Company was incorporated following the death of Mr. Moss, and Mr. Fristoe was elected vice-president. In 1902, he was elected president, which position he held until 1928, when he retired and became chairman of the board of directors, a position he was holding at the time of his death. Mr. Fristoe also served as receiver for the Cape Girardeau Northern from 1914 to 1922. He was active in the affairs of the National Association of Railroad Tie Producers, and served as the first president of that organization.

Trade Publications

Dragline Buckets—The Bucyrus-Erie Company, South Milwaukee, Wis., has recently issued a bulletin describing and illustrating the various features of this company's new Red Arch dragline buckets.

No Scale, No Sludge, No Mud.—An interesting 36-page booklet has been published by the Permutit Company, New York, which describes in detail the application of Zeolite water softeners to the treatment of boiler feed water. The booklet is well illustrated with photographs and diagrams and contains considerable reference data, including conversion tables, water analysis and hardness conversion factors, and Zeolite water softening and regeneration reactions.

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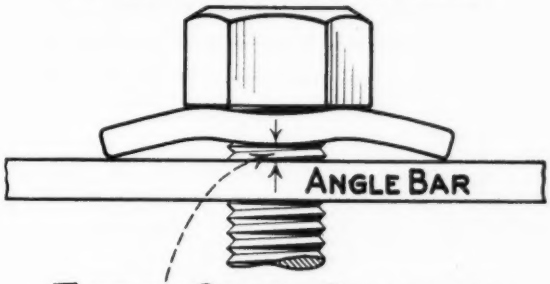

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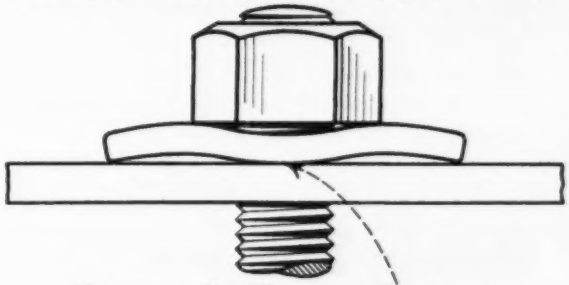

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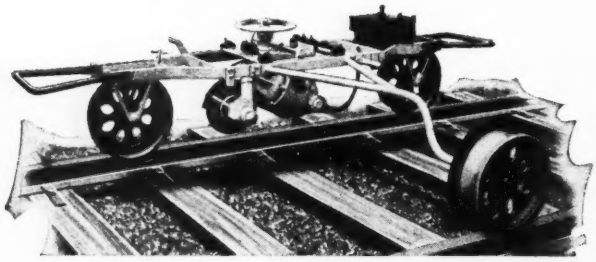

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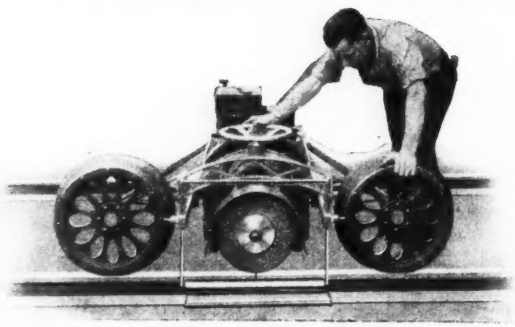

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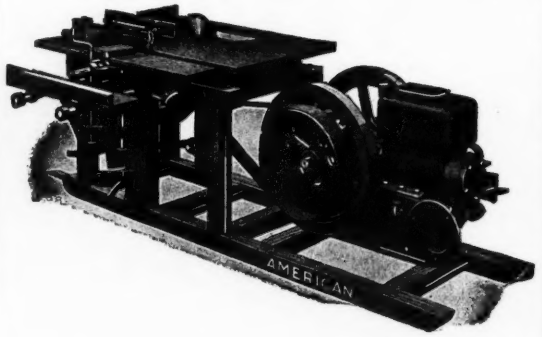

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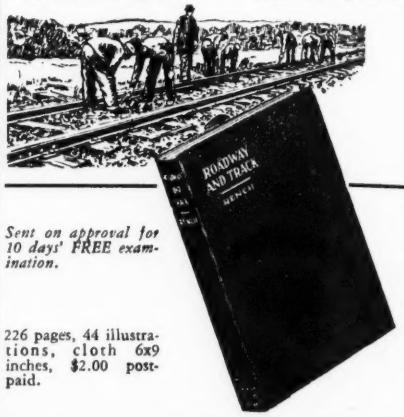

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DEARBORN CHEMICAL COMPANY

STATEMENT of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of RAILWAY ENGINEERING AND MAINTENANCE, published monthly at Milwaukee, Wis., for October, 1932.

State of Illinois } ss.
County of Cook }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Elmer T. Howson, who, having been duly sworn according to law, deposes and says that he is the editor of the RAILWAY ENGINEERING AND MAINTENANCE, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:
Publisher, Simmons-Boardman Publishing Company, 30 Church St., New York, N. Y.
Editor, Elmer T. Howson, 105 West Adams St., Chicago, Ill.
Managing Editor, Walter S. Lacher, 105 West Adams St., Chicago, Ill.
Business Manager, F. C. Koch, 30 Church St., New York, N. Y.

2. That the owners are:
Simmons-Boardman Publishing Co., 30 Church St., New York, N. Y.; Simmons-Boardman Publishing Corporation, 30 Church St., New York, N. Y. Stockholders of 1 per cent or more of the total amount of stock are: I. R. Simmons, 1625 Ditmas Ave., Brooklyn, N. Y.; P. A. Lee, Hopatcong, N. J.; H. Anderson, 246 Rugby Road, Brooklyn, N. Y.; E. G. Wright, 398 N. Walnut St., E. Orange, N. J.; S. O. Dunn, 105 W. Adams St., Chicago, Ill.; C. E. Dunn, 3500 Sheridan Rd., Chicago, Ill.; L. B. Sherman, 575 Sheridan Rd., Winnetka, Ill.; Mae E. Howson, 105 W. Adams St., Chicago, Ill.; B. L. Johnson, 105 W. Adams St., Chicago, Ill.; W. A. Radford, 407 So. Dearborn St., Chicago, Ill.; Spencer Trask & Company, 25 Broad St., New York, N. Y. Partners of Spencer Trask & Company are: E. M. Bulkley, Acosta Nichols, Cecil Barret, J. Graham Parsons, C. Everett Bacon, William R. Basset, F. Malbone Blodget, Percival Gilbert, Harry S. Allen, Harry A. Minton, William Beckers, W. V. C. Ruxton, Arthur H. Gilbert, all of 25 Broad St., New York, N. Y.; William E. Stanwood, 50 Congress St., Boston, Mass.; John Nightingale, 50 Congress St., Boston, Mass., and S. Bayard Colgate, Special Partner, 52 Wall St., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholders or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

ELMER T. HOWSON.

Sworn to and subscribed before me this 26th day of September, 1932.
ANNE A. BOYD.
[Seal] (My commission expires Dec. 8, 1934.)

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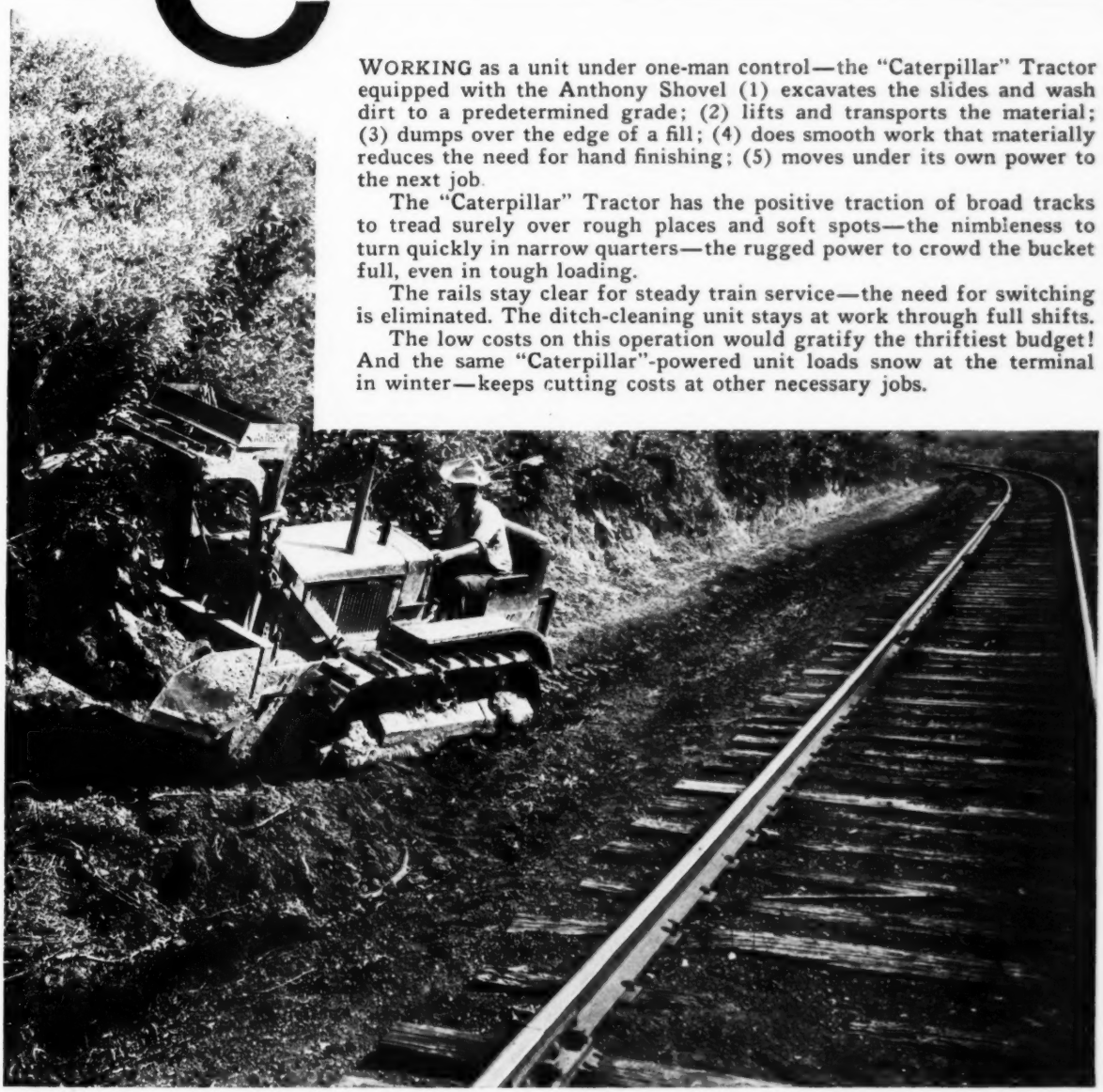

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